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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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A HOME-MADE DOG CHUCK.

BY OLLA PODRIDA.

UTILITY OF CHUCK—MATERIALS—COST—PROPORTIONATE DIMENSIONS OF BODY—MODE OF MAKING CHUCK—CONSTRUCTION OF DOGS.

THE chuck about to be described will be found useful for almost every variety of work, and, as far as the needs of an average amateur go, it will compete successfully and compare favourably with its expensive descendant—the four-jawed expanding chuck. It is, in the form given herein, easily made—no patterns or special process being necessary—at home, and with a little practice will give entire satisfaction to the user.

The materials required are within easy reach of every one, comprising a disc of hard wood for the body, some sheet iron for facing the front and back, and a few inches of square bar iron for the shanks of the dogs. The dogs may be made of angle iron or bent out of flat bar iron. The cost will, of course, depend on the size. For one about 8 or 9 inches in diameter the cost of materials would be about a shilling or eighteenpence.

Referring to the illustrations:—Fig. 1 is a front elevation showing the arrangement of the slots for receiving the dogs, which are four in number, one only being shown. Fig. 2 is a vertical section of the chuck through A, B, showing the construction more clearly. The thickness of this wooden part should not be less than $\frac{1}{8}$th of the diameter of the chuck; for example, a 9-in. chuck should have a body of wood at least $1\frac{1}{2}$ in. thick. The body or middle part, *a*, is of wood—box, beech, hornbeam, oak, mahogany, pitch pine, or other hard wood, This wooden part is faced on both sides with sheet iron, *b*, *b*, about $\frac{1}{16}$th or $\frac{1}{8}$th of an inch thick, secured by countersunk wood screws, as shown in Fig. 1. A plan of the dog is given in Fig. 3, but the construction will be better comprehended from Fig. 2, where it is also shown in section.

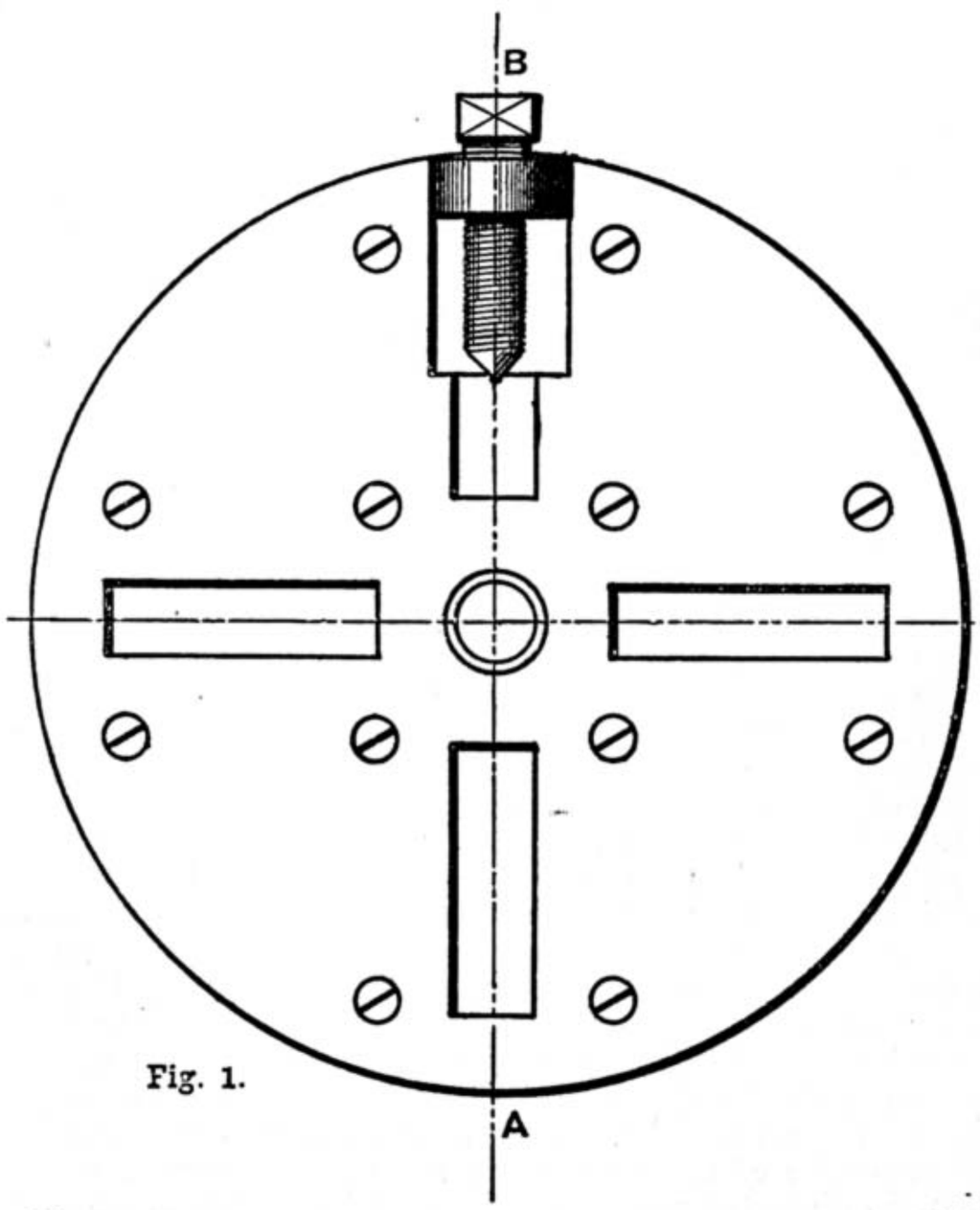

Fig. 1.

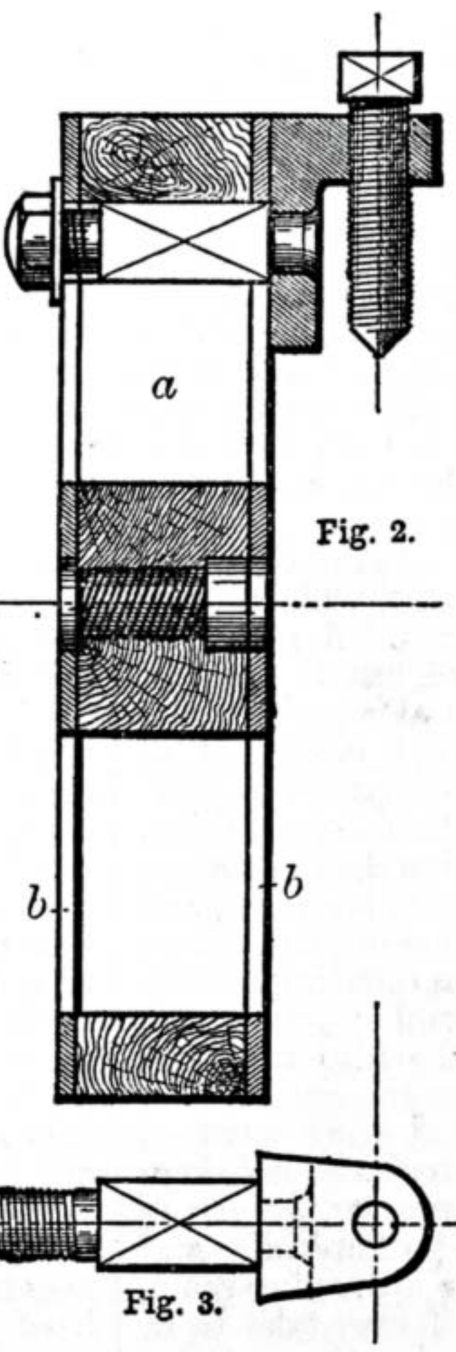

Fig. 2.

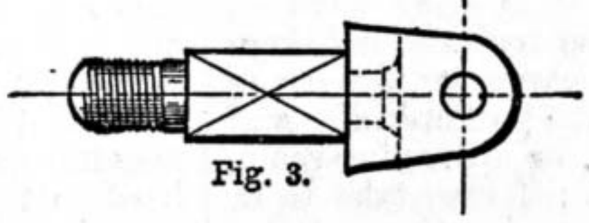

Fig. 3.

Fig. 1.—Home-Made Dog Chuck: Front Elevation. Fig. 2.—Section through line, A, B, in Fig. 1. Fig. 3.—Plan of Dog.

In making the chuck, first get a piece of wood of suitable size for the body, plane one side, and strike out the size with the compasses and rough out slightly larger to allow for turning. Bore and tap the centre to suit nose of mandrel; the thread, with care, can be formed by the mandrel nose itself if no suitable tap is at hand. By the way, every amateur lathesman should have a set of taps corresponding with the mandrel of his machine. Returning to the subject, the next thing is to prepare the sheet iron facing for the back by striking out a circular piece to the right size and marking out the slots, which must be cut before fixing on the wood. These slots must be drilled and filed out to suit the dog shanks; they must not be cut straight out with a chisel; by so doing the plate would be buckled beyond recognition. A hole must be drilled in the centre to clear nose of mandrel. The holes for screws must also be drilled and countersunk for stout screws; these screws to be rather less than half the thickness of chuck in length, so as to avoid fouling the others in front. The plate having been fixed, the chuck at this stage must be screwed on the mandrel and turned and faced truly. This done it must be removed and the slots cut through the wood by first boring holes through with a centre-bit, and shaping out the remainder with chisel, and rasp, or coarse file, care being taken that the slots, when finished, are square to the face. The plate may now be prepared for the front of chuck by cutting a piece to the size and marking the positions of the slots from the chuck by laying the latter upon the plate and tracing the outlines of the slots with a scriber, noting the position in which this is done so that the plate may readily be replaced in the position from which it was marked. The screw holes being drilled and countersunk the plate can be finally fixed, and in doing so the slots must be kept fair with each other. Trifling inequalities in these slots can be removed with a file after the whole has been put together. The periphery of the chuck can be turned up, and the clearing hole in centre of front plate bored in place. If convenient, a slight cut may be run over the face, but if the iron plate on the front has been well bedded this should be unnecessary. The chuck is now ready for the dogs.

These dogs are made of wrought iron. The shanks are formed out of bar iron $\frac{1}{2}$ in. square, rounded down to $\frac{3}{8}$ in. diameter at the back ends and screwed for nuts. The front ends are rounded to $\frac{7}{16}$ in. diameter, and the dog riveted on as shown in Fig. 2. Cold riveting will do, but hot is best, and a notch should be cut in one side of the hole so that when riveted on there shall be no tendency on the part of the dog to turn and become loose on the shank. In riveting, the shank must be held in a vice by the square part. The dog screws may be made from $\frac{7}{16}$ in. square bar iron, rounded down and screwed with conical points slightly flattened and case hardened, but the best job would be to make them of steel and lightly temper the points. The screws must be arranged so that they or the dogs may be reversed if required, and they must fit well in the holes. The dogs may be made by bending suitable pieces of flat iron, or they may be cut out of angle iron if the latter is obtainable. To avoid injury to work from the points of the screws, small pieces of iron, slightly curved for round work, and

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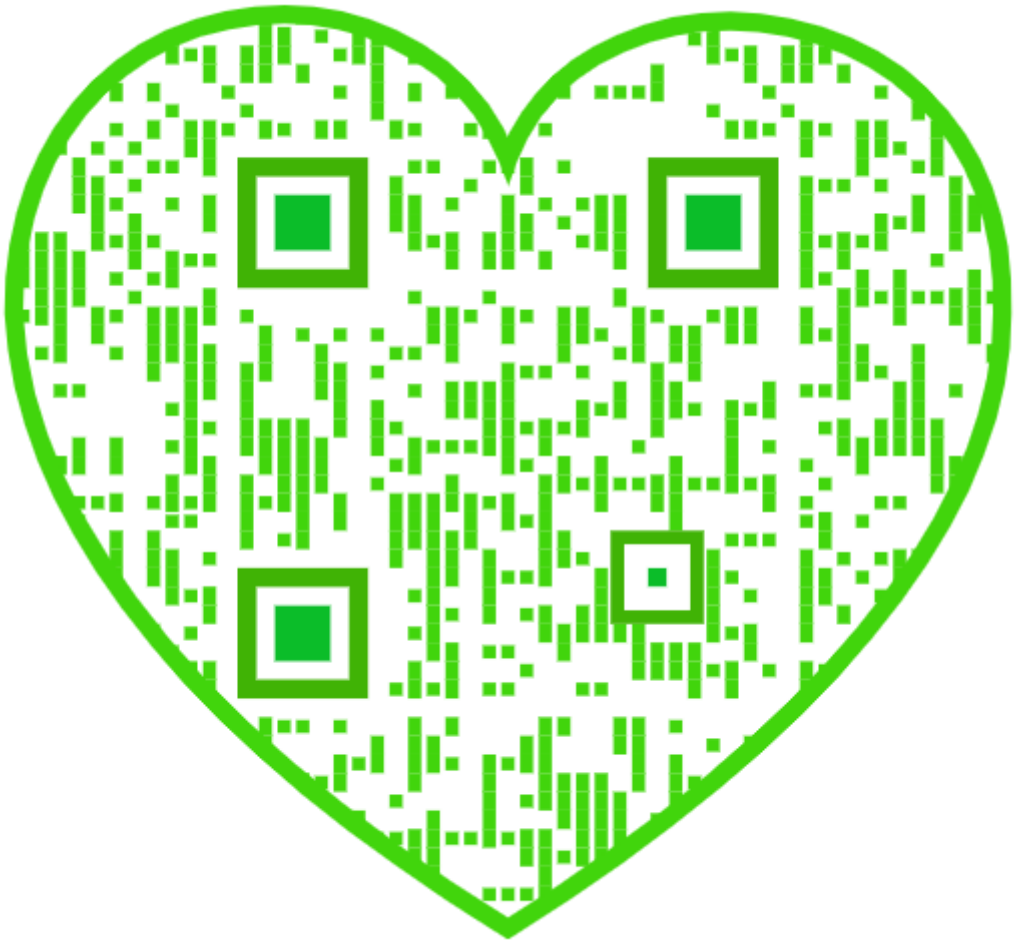

provided with a countersink on the convex side for the conical points of the dog screws, should be interposed. The dog screws should always be kept short, or project as little as possible between the dogs and the work, so as to avoid injury to them by bending.

Other uses might be suggested for this form of chuck, such as providing it with a few extra holes between the slots so that work might be bolted on to it or otherwise attached than by the dogs, which, of course, can at any time be removed; but, as space is limited, I leave such to the ingenuity of the worker, which, especially if sharpened on the grindstone of necessity, will readily adapt the circumstances to his needs.

LATHES AND TURNING APPLIANCES.

BY F. A. M.

I.—Introductory.—How to Choose a Lathe.

Man has been described as "a tool-making animal." He is probably the only animal with brains enough to enable him to see the value of tools, and with dexterity enough to make and apply them. If any one doubts the value of tools let him for a moment imagine what would be our condition without them, and he will very quickly be convinced that were we confined to our teeth and nails, and allowed to use no other implements than these, we should have to return to the existence of the most degraded savages. Gold, jewels, and rich robes, etc., may be precious, but far more precious still are tools. Look with respect, then, gentles, at the carpenter's bench and basket of tools, at the blacksmith's anvil and vice, for you could more easily dispense with your carriages and horses, your houses and parks, than you could do without these.

All work but the most mechanical is done with tools, therefore Work will be constantly occupied with them. A man may turn a crank without a tool, but this sort of work employs his muscles alone, his animal nature; and it is more and more left to animals and to the forces of nature.

Now of all tools the lathe is the king. Much as the steam engine has done for humanity, the lathe has done far more, and without it both the steam engine, and almost every other machine, would be impossible. Parents, do your boys trouble you in the holidays by knocking nails into the doors and carving their names on the gate? Perhaps you never considered they have an instinctive desire to use tools. Send them for an hour a day to a carpenter, get them some tools other than the pocket-knife, and set apart an outhouse, or a dressing-room, as a workshop for them; if they take to it, and work with perseverance, buy them a lathe.

I will here stop to confess that I am something of an enthusiast on the subject of the lathe, and I had better say so, lest my readers should fail to discover it. My own dear father gave me a lathe when I was fourteen years old; I climbed a high tree that looked along the road, and stayed there about three hours, watching for the cart which was to bring it from the station. It was a very suitable boy's lathe, costing £5; all iron, 3½ in. centres, and 3 ft. long. I have it now; it has been a great pleasure to me, and is so still; never were £5 better spent!

Before going into the general question of "How to Choose a Lathe," I may say here that, for a boy of fourteen, I do not advise an expensive lathe, lest the desire to turn should not prove permanent; besides this, a boy's small lathe will always be useful in after years, even when the turner has a more expensive one, a second and smaller lathe being a great convenience. As I intend to mention the names of several manufacturers in connection with the work in which I think they excel, I may say here that for a boy's lathe of the size here mentioned I should go to Charles Taylor, of Edmund Street, Birmingham, whose price is £4 15s. He supplies a small slide rest to suit for £2 18s., and a complete turning outfit, comprising 3½ in. centre lathe, slide rest, chucks, tools, and drills, for £11. With this outfit a boy might set to work at once upon small nicknacks, boxes, chess-men, etc. etc., in wood; and if in addition be added a 10s. 6d. parallel vice, and some files, taps and dies, rhymers, etc., he could fit up a model engine.

Let us now approach the question, "How to Choose a Lathe," from the grown-up amateur's, or mechanic's, point of view. It is a wide question, since the *kind* of lathe depends on the *kind* of work to be done with it, and the *quality*, or perfection of the lathe, on the depth of the purse. I can only hope, then, to offer such remarks as may enable my readers to choose for themselves according to their own requirements. Remembering, then, that we are dealing with foot lathes exclusively, we may say they can be broadly divided into two kinds, viz., those for turning wood, and those for turning metal; also some desire to combine the two.

Wood Lathes.—Suppose a carpenter, or cabinet maker, wishes to take up turning, he should look to three things—first, he will want high centres and a long bed, say 7 in. or 8 in. centres, and a bed that will take in work 4 ft. or 5 ft. long; second, he will want an easy-running lathe, therefore the mandrel must be of small diameter in the neck and run on a back-centre screw behind; third, he should have a mandrel of a good length, say 8 in. to 12 in. long, from collar to hinder end. A wood-turner's lathe must run fast, and if the bearing surfaces of the mandrel are large it will drive hard. You cannot tell whether a lathe runs easily by simply putting the foot on and driving it round, unless at the same time you notice how many times the mandrel turns to each turn of the crank, or, in other words, what is the speed ratio of the pulleys. A proper speed ratio for wood turning is 8 to 1, and at this speed the lathe should run easily or it is not fit for wood turning. This it will not do if the collar of the mandrel is more than 1¼ in. in diameter and ⅝ in. long, or it may be 1 in. long by 1 in. diameter. The mandrel neck and collar should be perfectly hard so that no file will scratch them. I once bought such a lathe, for a workman friend, for £2; it was second-hand, and rough to look at, but very useful and light to turn; it is, no doubt, a bargain, but such lathes are to be met with for £3 or £4. A carpenter could make the frame of the lathe himself, and buy the headstocks, rest, wheel, and crank axle. This sort of lathe would be a workman's tool—for use, not for show. A wood turner may very likely wish to put his work together with screws, and to produce screws in the lathe he will probably require a traversing mandrel. Writing from Tunbridge Wells, where such things are used, I may say the turners here pay a high price for a traversing mandrel and collar, and these they mount themselves in a wooden headstock. The makers of ornamental turning apparatus make very beautiful lathes with traversing mandrels—quite works of art—but they are very expensive. I do not know that a good traversing mandrel can be obtained at a moderate price, but the Britannia Company have lately brought out a lathe with traversing mandrel and overhead motion, called the "Lukin Lathe," a notice of which, with an illustration, will be found in page 13 (No. 1) of this Magazine.

A good lathe for wood can be obtained from J. Buck, of 56, Holborn Viaduct: 5 in. centre, £11 15s. This would have no traversing mandrel; it would be of iron, and would not have the capacity of the wood lathe first described, but it would be better-looking. Buck's next quality "best lathe," with divided pulley and very well finished, costs £19 5s.; but if one requires a traversing mandrel and overhead motion the price rises to £65, and you get a fine tool, fit for ornamental turning when the requisite apparatus is added. These lathes could have slide rests fitted and be used for *small* metal work, though, as they are intended for wood, they have no back gear, and therefore could not well deal with iron of over one inch in diameter.

Metal-turning Lathes.—We will now turn to those lathes which are intended for turning metals. Now, metals require a much slower speed; also a slide rest (of no use for wood) becomes almost a necessity. These lathes, then, are fitted with back gear and slide rest. They will turn wood, but not conveniently, because they are made for slower speeds than wood requires. Metal-turning lathes are made in great quantities, and the price has been reduced, by competition and improved methods of manufacture, to what would have been deemed incredible some time ago. Moreover, in this direction our English manufacturers appear to hold their own. Supposing, as before, that a workman wished for an iron-turning lathe of about 5 in. centre with slide rest and back gear, he would find a great number of makers ready to supply him. Perhaps the first thing he had better do would be to obtain "The Metal-Turner's Handbook," by P. N. Hasluck; because there he will have in a small compass illustrations of the work of some of the best known English makers, with short descriptions and prices. If the lathe is to be a slide lathe with saddle and leading screw, then, if a *small* lathe be required of 3½ in. centre for model engine making, or electrical work, etc., there is nothing to beat the Britannia's Company's No. 14 lathe at £18 18s. For larger sizes, perhaps Milnes of Bradford may be preferred; his 5 in. slide lathe, with hardened collars, cut gears, and full set of 22 change wheels, is £26. It is possible to get such a lathe for £20, but it is not desirable, unless it were second-hand, for the work could not be properly done for that money. Such a lathe as that some years ago would have cost twice as much. Buck's price for a similar tool is £34 10s., whilst Whitworth's would be about £80, and would be more accurate—or should be; but these lathes of H. Milnes and the Britannia Company are fairly accurate, and suitable both for workmen and for amateur engineers.

We come now to consider the requirements of amateurs who like variety; they like to buy very beautifully finished and accurately made apparatus, and to be able to congratulate themselves on the wonderful and curious shapes and curves they *could* produce. Then, perhaps, the lathe room is

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wanted for something else, or the owner removes, and the lathe is sold for half its value, slightly rusty, perhaps, and the lacquer scratched, but with much of its apparatus still unused and destined to remain so even if it pass through twenty hands. Yet, though they often do not use the appliances they have, amateurs have a way of wanting still more and more combinations, more and more possibilities in their lathes. An ornamental turning lathe will only deal with small metal work, and a metal-turning lathe is not suitable for ornamental work. The best way out of the difficulty would be to have *two* lathes, each perfect for its particular purpose; and some adopt this plan. But some still wish to combine the two objects, and this can be done to some extent. An ornamental lathe, which means a lathe intended for ornamental or complex turning, is a very beautiful piece of work, and very expensive. There are only some five or six makers of this class of work, and it is not wise to order it from any ordinary maker who might think himself able to produce it. First comes the plain part of the lathe as the foundation; it has usually a wooden frame and an iron bed, and should have a traversing mandrel; this plain part alone costs about £60. Then comes the various apparatus: the slide rest £28, the overhead motion £10, the various expensive chucks and cutting frames, and the box full of beautiful little moulded turning tools, with goniostat for sharpening them, which soon brings the amount up to £100, about the lowest price at which a lathe and apparatus for ornamental turning can be obtained new. If the complete set of apparatus is required, the price goes up to £500 and more; in fact, there is no end to the curious and ingenious appliances that can be added to the lathe; a geometric chuck may cost £100 alone.

The old-established firm of Holtzapffel and Company, of 64, Charing Cross, were formerly without a rival in the business of making lathes and tools of the highest class, and some still put them first, as they are certainly the most expensive, numbering amongst their customers peers of the realm. J. H. Evans, of 159, Wardour Street, comes next, and some put him first; he has adopted some more modern methods, and his prices are a little lower. Then come Messrs. G. Birch and Company, of Salford, Messrs. Cooke and Sons, of York, and Messrs. G. Plant and Son, Nelson Street, Birmingham, who make good lathes, and the speciality of the latter is the geometric chuck which bears his name. Evans, Birch, Cooke, and Plant have made lathes in which both metal and ornamental work could be done. Birch makes the medallion machine invented by Mr. Jesse Lowe, by means of which very beautiful work can be done, and also a rose-engine arrangement by the same inventor. Quite lately, a new firm, The London Lathe and Tool Company, 37, Pomeroy Street, London, S.E., has been established, and are making very good lathes for scientific and ornamental purposes, of modern design and at somewhat lower prices than formerly prevailed.

My readers will find that if they go to the makers of metal-turning slide lathes, such as Milnes or the Britannia Company, they will get far more for their money than if they go to the regular makers of amateurs' lathes for wood or ornamental turning; but I warn them that however well such lathes may be suited for metal work, they are too heavy and hard to drive for wood. Perhaps, however, one way out of the difficulty would be to order a 5 in. slide lathe made with a small or light mandrel with shorter collars, so that it might run more easily and thus be more suitable for wood; but then it would be less fit for metal work. Also, in turning wood upon a slide lathe, the slide rest, etc., must be got out of the way, and the cogs of the back gear and other parts which are so useful in metal turning are apt to get filled with chips.

Having now gone through all that need be said about the *kind* of lathe, before passing on to advise my readers as to how they may test the *quality* of the workmanship of any lathe offered them, I wish to advise them to obtain one or two of the numerous books on turning, as this will greatly help them in coming to a decision.

First and foremost must be mentioned the best work of all, Messrs. Holtzapffel's "Turning and Mechanical Manipulation," in six volumes, five of which are published. The first three volumes are on: I. Materials; II. Cutting Tools; III. Grinding Processes; full of interesting and very clear descriptions of all kinds of mechanical manipulation. With Vol. IV. we enter upon turning proper, its subject being Plain Turning; its price is 25s. Vol. V. treats of Ornamental or Complex Turning; it is full of most beautiful plates, and its price is 30s. There is nothing equal to these books. I will mention some less expensive works in my next paper.

(*To be continued.*)

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

II.—Preliminary Exercises.

For reasons which I shall state hereafter, in the chapter devoted to a review of the alphabet in its relation to sign writing and lettering, it is very essential that some practical knowledge should be obtained of freehand drawing and geometry. A little only is better than none at all; but the more the student learns the more will he be a master of his art. There is no necessity to dwell at length upon them here, so I shall confine myself to a few examples, in which it is absolutely necessary for the student to become proficient before he can hope to make correct formations of each individual letter of the alphabet.

In the first place, he must learn to draw in a bold, fearless style lines straight, horizontal, perpendicular, and oblique; and afterwards graceful curves. It must be understood that I am commencing with a short series of drawing lessons, so that the student should provide himself with a few sheets of common drawing paper, an HB. pencil, and a piece of indiarubber. The paper should be pinned to a drawing board, which may be purchased for about one shilling. The lines I have mentioned are the first exercises in freehand drawing, and, until these are thoroughly mastered, it is useless to attempt to proceed further.

To do good work at the outset of his career the draughtsman's pencil must be properly pointed—that being the first tool he will handle. This being accomplished, let him endeavour to draw a perpendicular straight line, A, in Fig. 1. This may be done the more easily by first marking it out as a dotted line, B, and afterwards filling it in with a firm, decided stroke from top to bottom. Horizontal and oblique lines are to be practised in the same way as shown in the examples C, D, E, in Fig. 1. Lines should also be drawn to meet each other at right, acute, and obtuse angles, as illustrated at A, B, C, in Fig. 2. The practice of drawing lines parallel to one another (Fig. 3) should also be persevered with. The student must next pay attention to curved lines, A, B, C, D, E (Fig. 4), and compound lines (Fig. 5), which may either be continuous or broken; and, following these, the circle and ellipse (Figs. 6 and 7) must be taken in hand.

Great patience, I am aware, is necessary in this, the initial and most uninteresting stage of our work; but this virtue, if persevered in, will be amply rewarded in the near future. In order to give more variety to the drawing lessons, the learner may presently proceed to copy, until perfect, such subjects as are shown in Figs. 8, 9, 10, all of which immediately concern the subject we have uppermost in our minds. As they are merely given as copies for incessant practice, they need no further description. These should be followed on with the alphabet drawn within faint-lined squares.

It will be helpful here to give descriptive definitions of those geometrical terms which the sign writer has most cause to make use of in his daily work:—

1. A *point* is a position in space which may be indicated on a plane by a simple mark or dot, or the intersection of two lines, or the extremities of two lines.

2. A *line* is an indication of division, or boundary generated by the motion of a point, and has only the property of length. There are straight or right lines, curved lines, and compound lines—the latter composed of right and curved lines. Compound lines are "continuous" when the curve continues the right line; and "broken," when the right and curved parts of the line form an angle. (See Fig. 5.)

3. When two right lines meet in a point, they form an *angle*, which is an indication of a portion of the space round the point; this space is, for the purpose of measurement of angles, supposed to be divided into 360 equal parts, called degrees. The length of the lines forming the side of the angle has nothing to do with its measurement. When two lines cross in such a way as to form four equal angles, they are said to be at right angles, or perpendicular to each other; an angle of one-fourth of the space, or ninety degrees, being called a right angle. An angle that contains less than a right angle is called acute; and an angle that is greater than a right angle is called obtuse.

4. Lines that are at an unvarying distance from each other, and thus would never meet if continued in either direction, are said to be parallel to each other.

5. A line, or combination of lines enclosing space, constitutes a *figure*. *Figures* are either rectilinear—composed of right lines; or curvilinear—composed of curved lines.

6. Right-lined figures are divided into *triangles* or *trilaterals*, having three sides; *quadrangles* or *quadrilaterals*, having four sides; and *polygons* or *multilaterals*, having more than four sides.

7. An *ellipse* is a figure of one continuous curve generated by the motion of a point in a plane, the sum of whose distances from two fixed points is always the same; these fixed points are called the *foci*. A right line drawn through these foci, and produced to the curve at both ends, is the *major axis* of the ellipse; and a line through the middle of the transverse diameter, perpendicular to it and extended to the curve on either side, is the *minor axis*, or diameter conjugate to the transverse. The point of intersection of the axes is the centre of the ellipse; and

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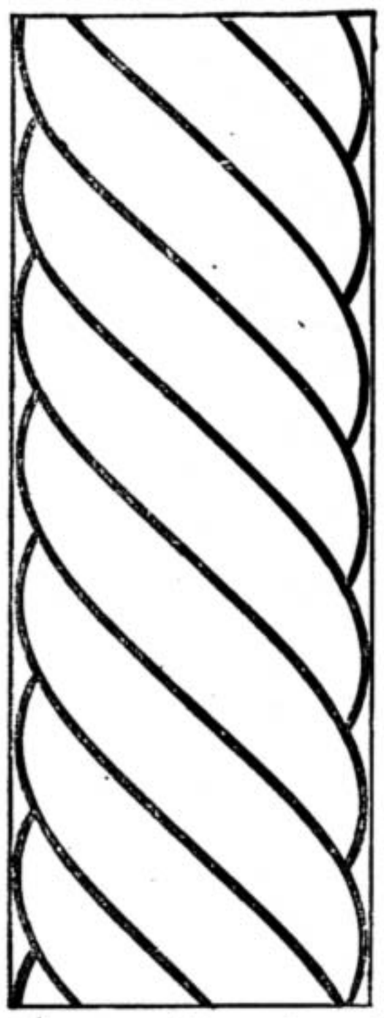

Fig. 9. — Example of Freehand Drawing—Twist as in Cable.

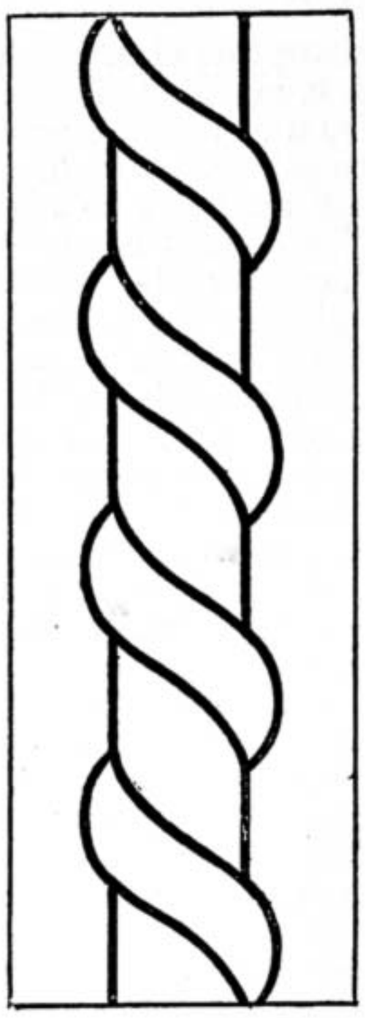

Fig. 8. — Example of Freehand Drawing—Coil Round Pole.

any right line drawn through the centre cuts the ellipse in two equal parts, and forms a diameter.

I have not the space here to give any geometrical problems; but it is advisable for the learner of the art of sign writing to obtain a good work on geometry, and carefully work out all those problems which are likely to prove most serviceable to him in his work. The elementary problems are those which he will find most useful.

As he will have occasion to make use of a blackboard for future lessons, I at once give directions for making one similar to the board shown in Fig. 11. Procure from the timber merchant's a good yellow deal board measuring 10ft. long by 9in. wide by $\frac{7}{8}$in. thick, and thoroughly dry and well seasoned. Also another board of the same wood, 12ft. by 9in. by 1in., for providing the legs and cross pieces of the stand, as shown in the illustration.

Take the first board, and, having squared both ends six inches from the outside, saw

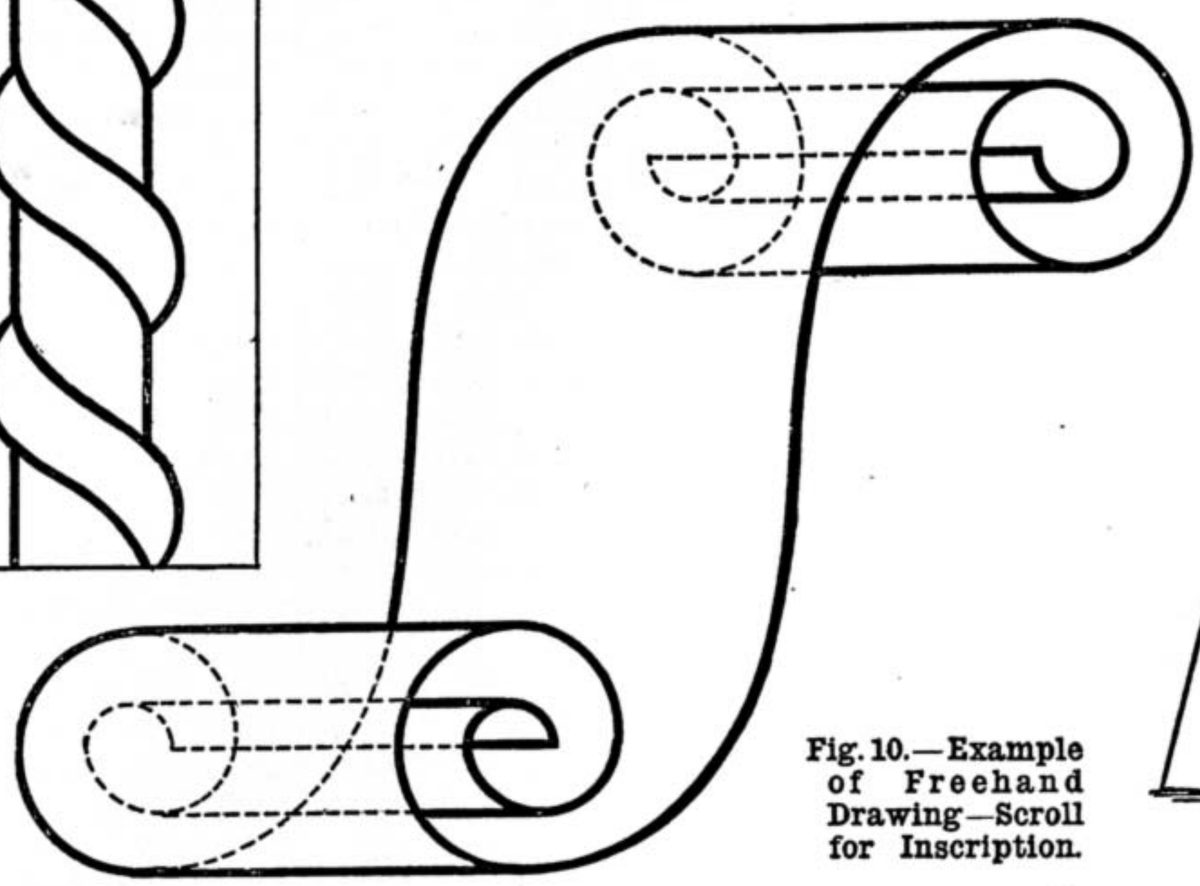

Fig. 10.—Example of Freehand Drawing—Scroll for Inscription.

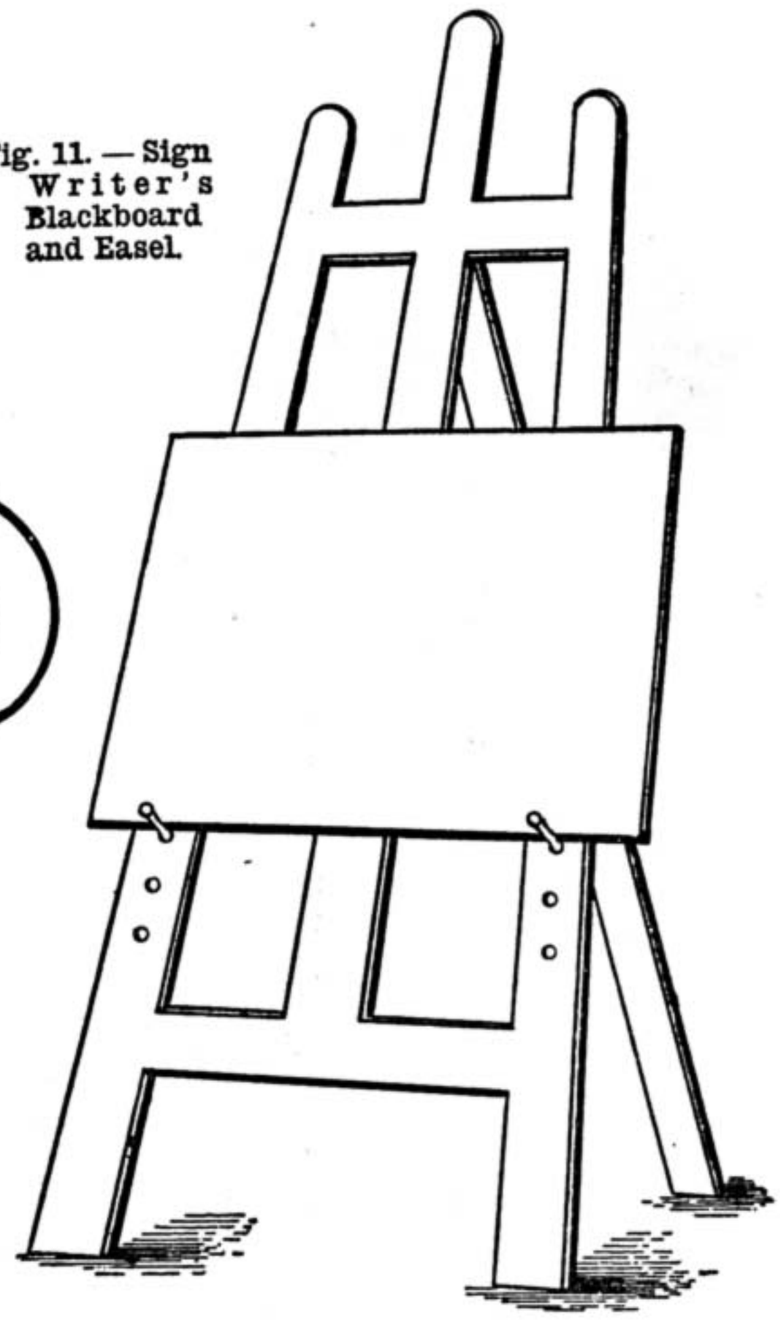

Fig. 11. — Sign Writer's Blackboard and Easel.

those off, and then saw the board into three equal lengths of 3ft. each; these three lengths should then be tongued and grooved in a workmanlike manner, glued, and clamped up until dry.

The framework, consisting of the two legs, the centre piece, and the two cross pieces, should then be put together with mortise and tenon joints, and this finally well screwed on to the back of the boards, and the hind leg attached with an ordinary "butt" hinge. The board must now have several coats of paint, containing plenty of dryers, and must be allowed to rest and be well sand-papered between each coat. When thoroughly dry it is fit for use, and should be in constant demand throughout the painter's lifetime for freehand sketching, lettering, and working out original designs that may suggest themselves.

If preferred—and this arrangement, possibly, will be found to be more convenient—the frame may form an easel, as shown in Fig. 11, the board being supported on pegs inserted in holes in the framework.

(*To be continued.*)

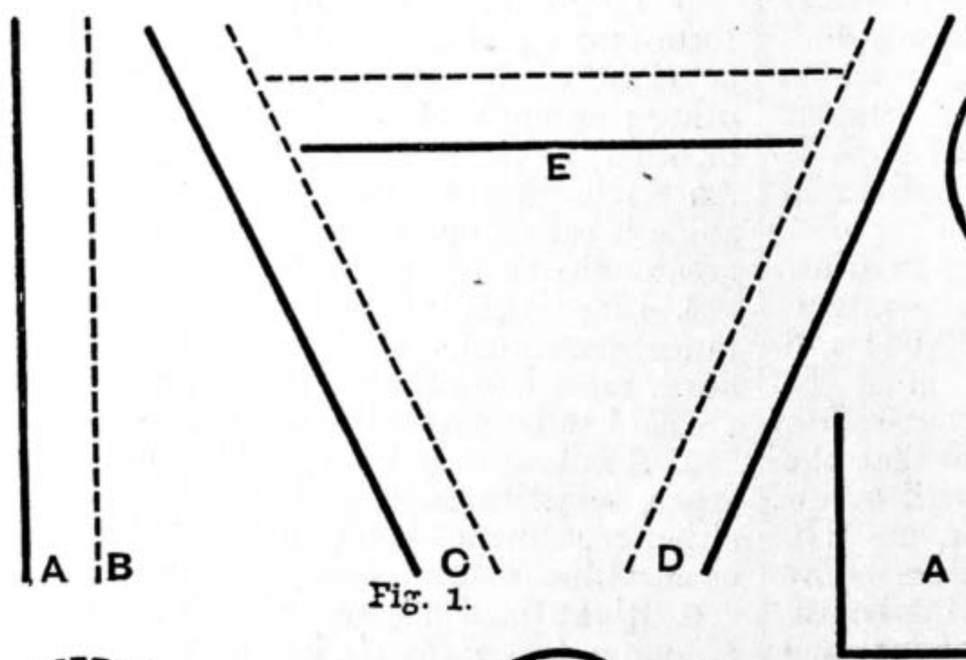

Fig. 1.

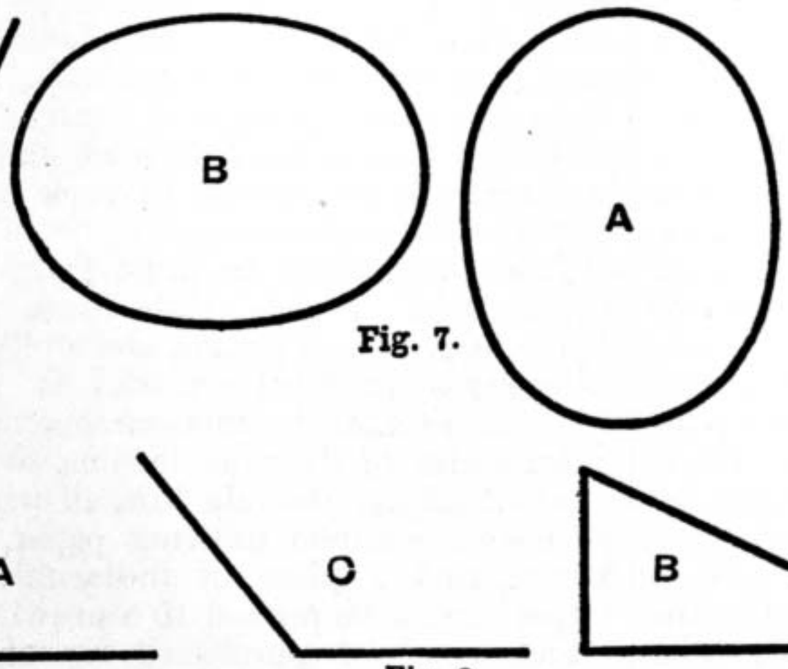

Fig. 7.

Fig. 2.

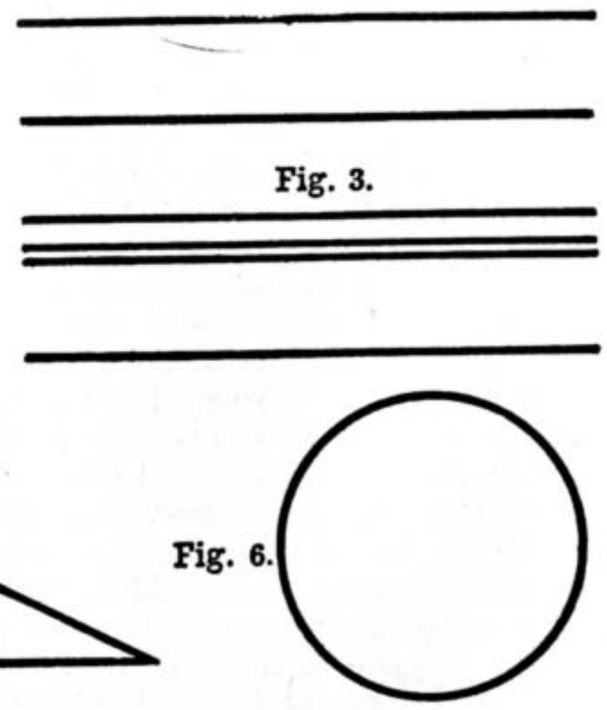

Fig. 3.

Fig. 6.

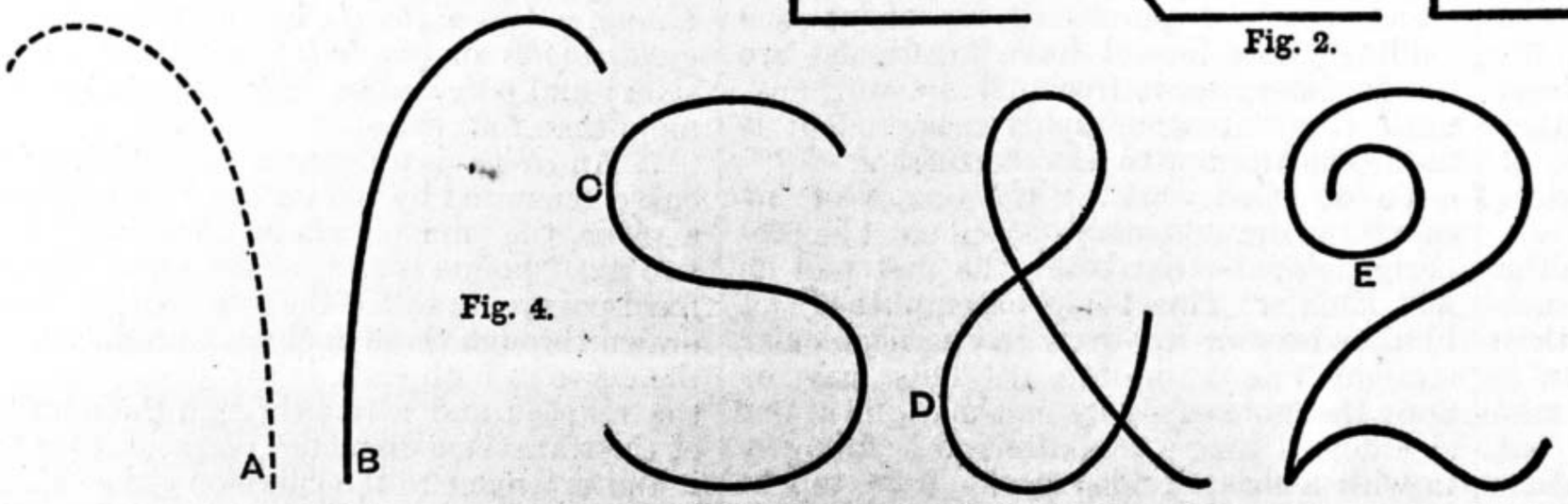

Fig. 4.

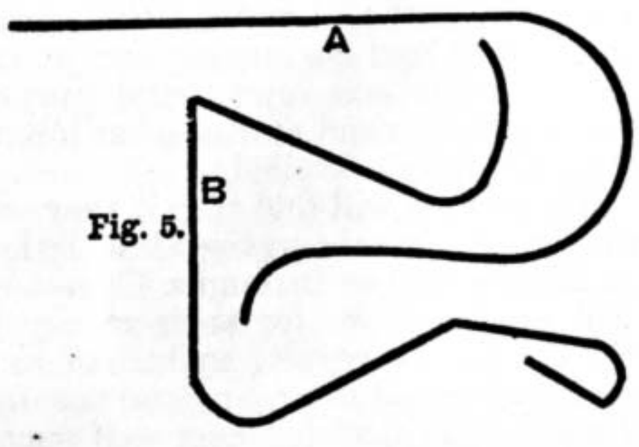

Fig. 5.

Elementary Lessons in Drawing for the Sign Writer. Fig. 1.—Straight, Horizontal, and Oblique Lines. Fig. 2.—Diagrams Illustrating the Meeting of Straight Lines in Points. Fig. 3.—Parallel Straight Lines. Fig. 4.—Examples of Curved Lines. Fig. 5.—Examples of Compound Lines, Continuous (A), Broken (B). Fig. 6.—Circle. Fig. 7.—Ellipse, Major Axis Perpendicular (A), ditto Horizontal (B).

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WHY DOES A TOOL CUT?

BY J. H.

I.—REQUISITES IN CUTTING TOOLS—STRENGTH AND SUPPORT—ANGLE OF RELIEF—FACE—PRACTICAL LIMIT OF ACUTENESS—LIMITING ANGLE FOR CUTTING TOOLS.

To some this may seem a stupid question, to which the obvious answer would be, "Because it is sharp." But that this is not a sufficient reply is apparent on a little consideration. Take a common wood-working chisel and try to cut a piece of iron or steel with it; the edge is turned over and spoiled directly. It fails to cut the iron or steel, not because it is not sharp enough, but because it is not *strong* enough; the form of the tool is such that it is too weak to do its work; in other words, the cutting edge lacks *support*.

It would, I imagine, be impossible in the absence of experience to predicate beforehand by a method of *à priori* reasoning what forms should be imparted to cutting tools in order to render them most suitably adapted for operating on materials of different kinds. A tentative method would have to be followed, and the tool-angles would have to be gradually increased until a happy mean was reached at which a reasonably permanent cutting edge should be secured. No such edge can be absolutely permanent, but in practice the tools used for metal working require, as a rule, regrinding and sharpening less frequently than those employed on the softer woods. This may appear paradoxical, but it is necessary, since it would be highly inconvenient when turning or boring work by slide rest which is required to be strictly parallel to have to remove the tool for grinding before the operation were finished.

When we have grasped the fact that *strength* is as important an element as keenness of edge, we may easily fall into error in the disposition of the necessary metal. We might so form our tools that they would be sufficiently strong, yet cease to act except by scraping. I will endeavour to render this matter clear by the aid of a few diagrams.

If we note the action of the chisel in Fig. 1, we see that the bevelled facet, A, is ground to make that angle with the lower face which happens to be best adapted for the removal of the largest quantity of material with the least expenditure of energy.

If the same chisel were presented to metal it would fail to operate. To make it cut metal, the angle of the facet would have to be increased in a tentative fashion (Fig. 2) until, say, for cast iron A would equal about 60°, and then, if thrust with sufficient force, it would cut after a fashion, because the cutting edge would be rendered sufficiently strong to withstand the stress imposed upon it. Actually, the tool used in practice would take the form of Fig. 3, in which the principle of Fig. 2 is embodied with certain necessary modifications. Let us look at this for a moment.

First, the absolute coincidence of the face of the tool with that of the work, which usually occurs in the wood-working chisel, would, when the contact of metal with metal is concerned, generate much friction and heat, with accompanying waste of power. The tool is therefore "relieved," or "backed-off," and the angle, B, in Fig. 3 is the "angle of relief," which is imparted to that extent which is necessary to prevent this injurious contact from taking place. By men ignorant of the principles of tool formation this angle is often unduly increased, and the consequence is that the cutting edge is much weakened by the unnecessary removal of the metal which is properly wanted to afford support to that edge. To take extreme cases, suppose the angle of relief were increased as in Fig. 4, it is obvious that the edge could not retain its permanence any better than that of the wood-working chisel when used on metal. Or, suppose the wood-working chisel to be thrown up at the angle indicated in Fig. 5, and thrust forcibly to its work by some strong coercive guidance—as the stock of a plane, for example—the edge would become blunted even on wood, and instead of chips or shavings being removed, fine dust only would be scraped off. We therefore find that we have not only to impart the angles

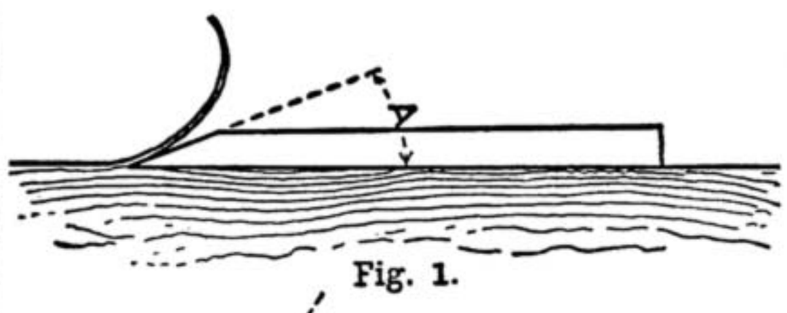

Fig. 1.

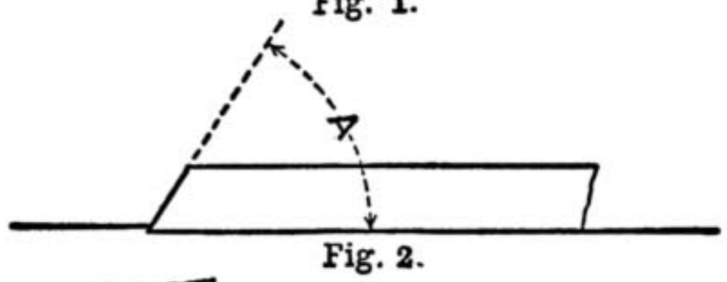

Fig. 2.

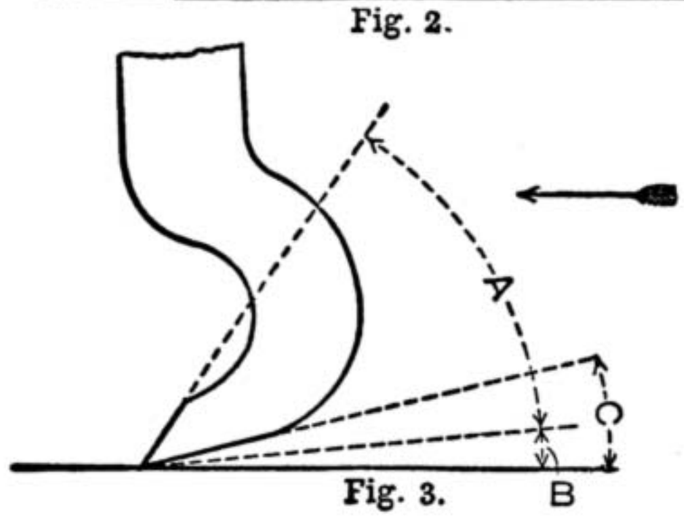

Fig. 3.

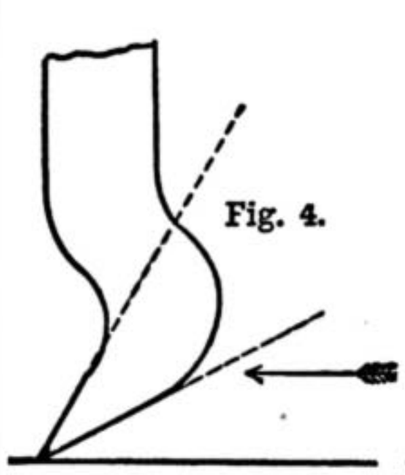

Fig. 4.

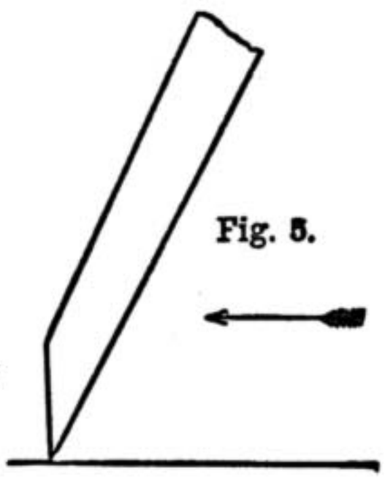

Fig. 5.

Fig. 1.—Wood-working Chisel. Fig. 2.—Angle necessary for Cutting Iron. Fig. 3.—Common Form of Tool for Planing or Turning Iron. Fig. 4.—Tool Badly Formed for Planing or Turning Iron. Fig. 5.—Diagram to Illustrate Improper Presentation of Chisel.

most suitable for cutting harder and softer materials respectively, but that we must, in order to diminish friction, have an angle of relief, whose amount, however, ought to be no more than sufficient to prevent rubbing of surfaces from taking place. The angle, C, in Fig. 3 is merely the angle at which the tool is roughly forged.

We may put this in another way, and say that the face of the tool ought always to approximate as nearly as possible, consistently with freedom from friction, with the face of the material which is being cut. After this, the settlement of the angle formed between the top and bottom faces is a matter to be determined by experience. But we may also say of this top face, too, that the nearer it can be made to coincide with the face of the material which is being operated on, the more perfect will be the action of the tool considered as a wedge. For all cutting tools, however uncanny their appearances, are in fact wedges, and operate by virtue of their wedge-like forms. The practical limit which determines the acuteness of the angles is the *permanence* of their edges. Hence, the harder the nature of the material, the more obtuse will be the angles of the tools. In the soft wood-working chisel, and spokeshave, and planes, the tool angles, A (Fig. 1), will vary from 15° to perhaps 25°. In the tools for turning the harder but fibrous wrought iron, the angle, A (Fig. 3), will be increased to about 50°. The tools for the still harder and more crystalline cast iron require to be ground to an angle of about 60°, while cast steel will often only yield to cutting tools whose angles are slightly more obtuse than this, or 65°.

We now approach the limiting angle for true cutting tools, namely, 90°. Yet there are materials, such as chilled iron and some kinds of steel which cannot even be cut with a tool, whose angle is as high as 65°; they, will only yield to a tool which is presented at an angle of 90° or thereabouts to them. But such a tool is no longer a wedge; it operates by scraping only.

To sum up, in order that a tool shall cut wedge-like action is necessary. But the degrees of acuteness of the wedges have to be widely modified for the operation of softer and harder materials, in order to afford sufficient permanence of cutting edge. The increase of metal imparted for this purpose must, for reasons of strength, be disposed as far as possible behind the cutting edge *in the line of action of the tool.* This cannot be absolutely the case, because of the amount of the angle of relief, which is necessary for clearance between the tool and the work; but this is the reason why the angle of relief should be kept as low as possible. These are axioms in tool formation, no matter how widely the shapes of the tools themselves vary. Practical conditions, however, often render such modifications necessary that the original idea or type becomes so disguised as not to be apparent at first sight.

Another matter, which has a marked influence on the action of a tool, is the frictional resistance of the shaving removed. Diminution of friction conduces to increased efficiency, and this is dependent partly on the nature of the material, partly on the angle of "top rake"—*i.e.*, of the upper face. Tools used for removing tough, fibrous material, such as wrought iron and mild steel, require a much greater amount of top rake than those employed on brittle cast iron, gun metal, and brass. In fact, in operating these alloys, whose shavings are highly crystalline, tools having no top rake at all—mere scrapes, whose faces stand perpendicularly to the work—are used. If such tools were employed on materials of the character first named, the continuity of the tough curling shavings would be very forcibly broken against the perpendicular face, and not only would a very wasteful excess of power be required to operate these tools, but it would be simply impossible to remove material in quantity. Giving ample top rake, however, the shavings curl down the top face, partly fractured, but with more or less of continuity remaining throughout their length.

In my next I will complete this subject by pointing out the application of these principles in the case of the common tools used for wood and metal working.

(To be continued.)

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THE BUNSEN BATTERY.

Its Construction and Application.

BY GEORGE EDWINSON BONNEY.

II.—ACID—SOLUTION FOR OUTER CELL—EFFECT OF NITRIC ACID IN SOLUTION—CHARGING BATTERY—CHEMICAL ACTION—CONNECTION OF CELLS—MEASUREMENT OF POWER OF BATTERY—TIME OF RUNNING—MAINTENANCE OF BATTERY—DOUBLE FLUID BICHROMATE AND CHROMIC ACID BATTERIES.

THE acid employed in the porous cell of the Bunsen battery, with the block of carbon, is the strongest commercial nitric acid or aquafortis undiluted. This will cost from 6d. to 8d. per lb., if bought in large quantity.

The solution for the outer or containing cell of the battery, with the zinc, is made up of commercial sulphuric acid (oil of vitriol) diluted with water in the proportion of one part acid to 8, 10, 12, or 15 parts of water as may be desired. This acid will cost from 2¼d. to 2½d. per lb. In buying from a respectable dealer there is little danger of getting bad acid, but I may point out here some of the impurities likely to interfere with the working of a battery, and the means for their detection.

If the acid contains any nitric acid the zincs will be violently attacked, the amalgam undermined, and the plates or cylinders will be honeycombed. Filling the porous cell above the level of the outer solution, a flaw in the cell, jolting of the cells, and similar accidents will get nitric acid in the outer solution. If this is tested with a few drops of indigo sulphate solution, the presence of nitric acid will be shown by the colour of the indigo solution being changed from blue to red. If the sulphuric acid or its solution contains any copper, this metal will deposit itself on the zinc amalgam, form a galvanic pair, or short circuit with the zinc, and wear pits in the cylinder. The presence of copper is easily detected by immersing a piece of bright steel, such as the blade of a knife, in the acid or its solution, when a film of copper will show itself on the steel if copper be present. Zincs thus pitted are only cleaned and reamalgamated with difficulty.

In making up the outer solution, first put the requisite quantity of water into a stoneware pitcher, then measure out the acid, and pour this gently into the water. Never pour water *into* sulphuric acid, for it combines with water in such a violent manner as to cause great heat, and the boiling mixture is spurted about in all directions. It will cause painful blisters and sores if splashed on the skin, and will ruin any kind of clothing. Let the mixture get quite cold before using it to charge the battery.

All things being now ready we will charge the battery. First rinse the cells with water. Place the carbon block in the porous cell and the zinc cylinder in the outer cell. Fill the porous cell with strong nitric acid to a height equal to that intended for the outer solution; then place the cell and its contents in the outer cell. Fill the outer cell with the dilute sulphuric acid solution, pour a teaspoonful of mercury into each cell; then put on the binding screws and clamps.

As soon as the circuit of the battery is closed—that is, when the free zinc at one end is connected by a wire, or through the working line, with the free carbon at the other end—a chemical action and interchange of elements take place within the cells and set up a general movement in the whole circuit. The force thus generated is named electricity. The action going on in the cells is probably as follows:—Small particles of the zinc become oxidised, and the oxidised zinc is taken up by the sulphuric acid to form zinc sulphate. In this action a part of the hydrogen found in sulphuric acid is set free and is sent into the inner cell by the current. Here it would fix itself to the carbon and check further action if it could not be dissolved; but it is met in the porous cell by part of the oxygen present in the nitric acid, and unites with it to form water. In this way the nitric acid loses a part of its oxygen and becomes nitrous acid.

The cells may be connected up in one of two ways to form a battery. Connect the carbon in one complete cell with the zinc in the other cell by means of a short wire, and continue to connect up the whole in line one after another until they are all linked together, with one free zinc at one end of the line, and a free carbon at the other. This is termed connecting up in series, and is employed to get an intense current capable of overcoming high resistance, such as there would be in an electric lamp or an induction coil. By this arrangement the electro-motive force (generally expressed in print by the abbreviation E.M.F.) of one cell is added to that of the next, and so on through the whole series. For instance: Suppose we employ six quart Bunsens in series. We will put the E.M.F. of one cell at 1·86 volts. This, multiplied by 6, will give us 11·16 volts.—the E.M.F. of the whole battery. The other way of connecting the cells is known by the term connecting in multiple arc or in parallel. In this method we place the cells in two parallel rows of three cells in each row. The cells in each row are connected in series, and this leaves two free zincs at one end to be connected to one line wire, and two free carbons at the other end to be connected to the other line wire. The difference between the two methods may be graphically shown thus:—

Series: —o—o—o—o—o—o—

Parallel: —<o—o—o / o—o—o>—

By this latter method we decrease the E.M.F., or pushing force of the battery, and increase the volume of electricity to be obtained from it, because we provide two conduits through which the current can flow. We therefore get a greater volume at a lower pressure.

The power of a battery, or any source of electricity, is capable of being accurately measured and determined according to a law called Ohm's law, discovered by a celebrated man bearing this name, several years ago. This law is expressed by the very simple formula, $C=\frac{E}{R}$, and is as simply interpreted thus:—The current of electricity equals the electro-motive force obtained from the generator divided by its internal resistance. Applying this law to the Bunsen battery, made up according to the two methods above indicated, we find the respective powers of the combinations to be as follows, the internal resistance of each cell being put approximately at ·08 volts:—

In series—

$$\text{E.M.F. } \frac{1{\cdot}86\times6=11{\cdot}16 \text{ volts.}}{\text{Resistance } {\cdot}08\times6={\cdot}48 \text{ Ohm.}} = 23{\cdot}25 \text{ Ampères.}$$

In parallel—

$$\text{E.M.F. } \frac{1{\cdot}86\times3=5{\cdot}58 \text{ volts.}}{\text{Resistance } {\cdot}08\times3={\cdot}24 \text{ Ohm.}} \times 2 = 46{\cdot}50 \text{ Ampères.}$$

This large volume of current is available for the work of electro-depositing metals. As the pressure of the current is low, it is incapable of overcoming a high external resistance, so we must use thick conductors in the line wire to and from the work. In the parallel arrangement we have two batteries of three cells each, giving up their united currents together; and as this has to be carried by one line, we must increase its capacity.

The time during which a Bunsen battery will maintain a constant current, varies with the load of work put upon it. If short circuited or placed on one of low resistance, it will warm to the work and give a powerful current for a short time, whilst giving off dense and pungent fumes of nitrous oxide from the inner cell. On electric light work it will usually run from six to eight hours without recharging, if put up in a proper manner. On electro-depositing work, with a weaker solution in the outer cells, it will run for ten hours and do good work in the last.

To maintain the battery in good working order, it should have care and attention at the end of the day's work. When its task is done, unscrew all the binding screws and clamps and put them in a little water to dissolve any salts that may be formed on the threads by the fumes from the acid. Take out the carbons, wash them in water, and set them on a shelf. Empty the contents of the porous pots into a jug or pitcher, and note the colour of the acid. If this is dark green and emits orange-coloured fumes it may be used again; but if a pale green, or without colour and fumeless, throw it away, and use fresh acid when the battery is again charged. Take out the zincs and examine them for signs of pitting. Well brush each in clean water, reamalgamate them if necessary, and set them aside to drain. Pour the outer solution into a pitcher for use again (and again until it becomes too much charged with zinc sulphate), unless spoilt with nitric acid. Rinse out the containing cells, fill the porous and outer cells with water, and let them stand, one in the other, till wanted again. Wipe the binding screws and clamps on an old rag and smear the threads of the screws with a little oil or vaseline. Cells put away in this careful manner are always ready for use and will work well.

All this labour is deemed troublesome by some persons; but I can assure them that it is as necessary to be done as the unharnessing and grooming of a horse at the end of his journey; and it does not seem to me to be more troublesome. Men do not expect to work a horse, or a steam engine, day after day without daily attention in feeding and cleaning, but they want an electric battery to run for months without both.

The Bunsen is a useful battery wherever a full, strong, and constant current of electricity is wanted. It has been in use with experimenters in the production of electric light, and has been a necessary adjunct to the laboratory of the chemist for many years. Its chief fault seems to be that it gives off noxious and destructive fumes whilst at work. This causes its banishment from workshops to boxes or small houses built outside, from which the line wires are led into the shop. It has been suggested that the best way to mitigate the nuisance is to enclose the battery in a box and keep it packed with wadding or blotting paper soaked in ammonia. If the porous cell is filled with sulphuric instead of nitric acid, the battery yields a mild current suitable to the requirements of electro gilders and platers working in a small way, as it then does not emit any fumes whilst at work.

As the same cells and the same elements

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may be used in making up double fluid bichromate and chromic acid batteries, I will conclude with a few remarks on these. In making up a bichromate battery a solution of bichromate of potash replaces the nitric acid in the porous cell alone, the charge for the outer cell being the same as that for the Bunsen. The bichromate of potash solution is made as follows:—Dissolve four ounces of bichromate of potash in one pint of hot water, and add to it, when cold, three fluid ounces of sulphuric acid. When this is cold it is fit for use in the battery. When this solution becomes green it is worn out, and must then be renewed. The fumes are not generally considered to be so objectionable as those from the Bunsen; the E.M.F. is higher at starting, but falls off slightly in a short time, unless the solution is kept heated or agitated; but the battery recovers itself when the circuit is broken.

If chromic acid is used, instead of bichromate of potash, in making up the solution, it will give better results, and will not so readily crystallise on the carbons and in the pores of the cells.

(*To be continued.*)

ARTISTIC FURNITURE

EASILY MADE AND CHEAPLY PRODUCED.

BY DAVID ADAMSON.

INTRODUCTION—UTILISATION OF PACKING CASES—JOINTS AND JOINTING—PINNED JOINTS—NAILED JOINTS—SCREWS IN DOOR MAKING—MATERIALS—SEASONING—STAINING, ETC.—FULL-SIZE DRAWING—DIMENSIONS—HOW TO MAKE OVERMANTEL—ENDS ON UPRIGHTS—BOTTOMS OF CUPBOARDS AND SHELVES—RECESS FOR FRIEZE—FRIEZE—FITTING FRIEZE—FIXING PARTS—SKEW NAILING.

IN the present series of articles I hope to describe the construction of various pieces of furniture, not as usually made, but specially adapted for the amateur cabinet maker, whose skill, means, or time is too limited to permit him to be a proficient in wood working. At the same time, while the things are to be of the simplest construction, and of the commonest material, they must not so far depart from ordinary domestic furniture in appearance as to proclaim the fact that they are anything out of the common. If you will permit me to do so, I will, as it were, take you at once into my confidence and explain the origin of the furniture to which I refer, just by way of introduction.

Some time ago I had in my possession some large packing cases which seemed too good to break up for firewood, but were very much in the way. Those packing cases became at last a kind of white elephant. No one would take them unless made into small firewood, so they remained lumbering up till one day, in an idle moment, I did some hard work—I thought—and this is something how my ideas ran. I should here state that I had long been contemplating getting an overmantel for my workroom or study, or, as it is disrespectfully called sometimes by friends, my "den." A costly affair was out of the question, and as a few rough shelves would answer my purpose just as well, I had almost decided on putting them up. However, being tolerably familiar with construction and other matters pertaining to furniture, it occurred to me that something more agreeable to look at than plain shelves might be put up with very little more trouble or cost. Could not the packing cases be used up somehow? The wood of which they were composed was sound enough, fairly clean, and about an inch thick. Some of the planks had rather more knots than might be desirable, but, on the whole, two or three cases represented a tolerably large quantity of workable material, costing, under the circumstances, nothing. But then the time; how could that be obtained from more important work? I had no fancy for having a piece of unfinished work lying about for an indefinite time. This necessitated something much simpler in construction than that generally found in furniture, and—in short, the overmantel shown in Fig. 1 was finally evolved, the first of a series of things designed on similar principles.

Possibly some may ask why these details of a personal character should have been given. Well, there's an old saying connected with sauce and a well-known feathered biped. Consider the circumstances in which the furniture originated as the sauce, and apply them personally. In other words, whatever the reasons may be, no doubt I am not the only one who has wanted to make simple furniture cheaply and expeditiously, and I trust the directions, founded on my own experience, may be of service to those who want to make such. By way of encouragement to those who are not adepts in carpentering work, I may here say that very little skill will enable any one to make up the various articles with a few ordinary tools. Difficult joints, or those that are so to the novice, are dispensed with wherever it has been practicable to do so. I refer, of course, to dovetails, mortises, and tenons, and other details which are so easy to read about, and look so easy when done by an expert, but which are so difficult to construct properly by those who have not "served their time." Instead of these ordinary workshop joints, nails, glue, blocks, and square cutting have been relied on.

Now, at this confession, my readers, don't turn away in disgust with the idea that some puerile contrivances are to be shown, or that the articles are shams—unenduring, flimsy things, not worthy of serious attention. Nothing of the kind; they may be as well put together, and as honestly made, as the most costly furniture, only there is not so much work in them. It has been said that good joinery should be firm without either nails or glue, and if these articles of furniture are to be judged by that standard, they will most assuredly be found wanting. This time-honoured statement, however, is, I venture to think, fallacious, and will hardly be seriously regarded by any who are not prejudiced against modern work, or rather modes of work and construction. Even those who have by practice become proficients in wood working—*i.e.*, cabinet making and joinery—whether as professionals or amateurs, may be disposed to look askance at any furniture made as this is described. Their scruples are entitled to respect; and, at the risk of being digressive, I venture to make a few remarks, for the consideration both of the artisan and the amateur, in justification of the simple construction of this easily-made furniture. I shall presume that I am addressing reasonable men, not those who regard age and goodness in wood work as synonymous, but men whose practical knowledge is sufficient to enable them to discriminate between good and bad workmanship, irrespective of its antiquity.

Apropos of this, it is strange that those who are never tired of belauding old work and decrying new, seldom know anything practically of the work. These antiquarian "cranks" carry their notions to extremes; but when any new method of work is proposed, are we not all more or less actuated by the same spirit of conservatism? They advocate the retention of "pinned" joints, such as were used so much in old wood work. We know this mode of fastening to be quite unnecessary with a well-made mortise and tenon, but coming to every-day usage, what are we to say about some of our constructive detail, the dovetail joint, for example? Are we to consider that this is necessary, while the former—the pinned tenon—is useless? Now, I have not a word to say against dovetails, or any other joint which experience has proved to be good and useful, but I maintain that we are sometimes rather inclined to be governed by tradition in our constructive details. A certain form has been regarded as the only permissible one, and we adhere to it as if it were absolute perfection, and that any departure from it would proclaim bad workmanship. Possibly it might, but by no means necessarily so. We must not forget that under altered conditions in the way of improved tools, together with improved accuracy in work, it is unreasonable to suppose that new forms of construction may not sometimes be desirable.

Among other matters, we overlook the fact that screw nails, and, indeed, all nails, as now produced, are of comparatively recent introduction; and without going so far as to say they ought to supersede the more customary forms of joints in cabinet work—for I am not prepared to go that length—I think we might make more use of nailed joints than we do, when time, and consequently cost of production, are important items. That a nailed joint will be better than a dovetail of course cannot be argued, but there can be no doubt that it is much more easily made, and there is no reason why it should not be equally strong. On this account I have no hesitation in recommending its use among amateurs in such simple furniture as I am about to describe. Everybody knows the holding power of screw nails, which are now brought to such perfection that they can be used with the utmost facility by the merest tyro; nor can they be considered in themselves as detracting from the appearance of any work in which they may be visible. It is not customary for them to be so, but it is very easy to conceive that sometime or other they may be regarded as ornamental rather than the reverse. Surely nothing can be urged against the appearance of a well-finished brass-headed screw. I am sometimes surprised that those who profess to admire the old-fashioned so-called honest work of our forefathers—a long way back—do not recognise that much of the detail is barbarously crude and uncouth, and that we moderns may turn out work equally good, and better finished, and more simply constructed, by taking full advantage of modern facilities. If any one cannot manage to make a tenoned door frame hold together, or, in other words, cannot work so accurately that the parts all fit so perfectly together that glue alone may be depended on, and requires to use nails of some sort, why should he make use of wooden pins? Surely screw nails are better in every way. Their only disadvantage is that they have not the merit of having been used some three centuries ago, and that is not a serious one. Probably the only reason for pins having been preferred then was because they were Hobson's choice, but as for us, why should we use them when we can get the altogether more satisfactory screw nail?

Reverting to the door framing, and going a step further, why, when screws can be used, should the mortise and tenon be considered

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indispensable? Although I do not say it is not the best, surely it is not the only one, for if the ends of rails and styles are halved and screwed together, the desired object is attained. I would like to say more on this topic, but having shown, to some extent, the principles on which this easily-made furniture is designed, and, I trust, suggested, not only to the novice but to the professional worker, that it may be sometimes well to depart from inherited notions about construction, or, at any rate, that it is not altogether necessary to adhere to them, more need not be said at present. Those who differ from me in my advocacy of simpler, and what to them will seem "jerry," construction, will please remember that I am describing furniture for amateurs to make. I have no sympathy with slop work of any description, but I do most emphatically protest against the idea that only one method is permissible under any circumstances. At the same time I do not advocate that the tyro, either in theoretical knowledge or technical skill, should, without consideration and sufficient reason, depart from those details of construction which are generally employed, as they are the essence of generations of practical workers' experience, and it is seldom that any serious objection can be raised against them on the score of efficiency. Those who wish to make up any of the designs in a way more in accordance with the recognised cabinet-making construction will have no difficulty in doing so, if they are able to "set out" work, but I wish it distinctly understood that these chapters are intentionally of an elementary character, and complicated technicalities will as far as possible be avoided.

Reference has been made to packing cases as the source of the material. For those who are not acquainted with them, I may say, that those cases which have contained pianos or American organs, etc., are very suitable for the purpose. They are generally well made, and in many of them the boards being ploughed and tongued together dry, *i.e.*, without glue, a great amount of labour is saved in "jointing up" to obtain width. I have never experienced any difficulty in obtaining such cases at a price which renders them very economical material, and, as some idea to guide the purchaser, I may say that at 5s. or 6s. he will not find a good, clean case dear. They are, however, to be had lower than that occasionally. Perhaps other large cases would do as well, but I mention the kind I have, because I have used them satisfactorily. Of course, the people to purchase them from are importers of musical instruments, and I believe in the larger provincial towns, the cases can be more readily got than in London. Anyway, there is, beyond their cheapness, no special reason why they should be used in preference to new wood. This can be got anywhere, and as the wood of which the furniture is made is pine, it ought not to cost much. Mahogany or some of the choicer woods may be used instead, but for this particular furniture it will be seen as we proceed that they are not so suitable. The only caution I have to give the novice is to see that the pine is of the best quality. This will cost more in the first instance, but in the end will prove more economical than inferior descriptions, as there will be so much less waste from knots and other defects. Even with the best there will be some knots. If the furniture is to be painted, these will not be of so much consequence, but if it is to be finished by either varnishing or polishing, care should be exercised to use only pieces which are free from knots. In either case, the fewer there are of them the better, as no one who has done any carpentering will need to be reminded that it is much easier to work wood in which the grain is nice and even than to smooth a piece in which there are knots.

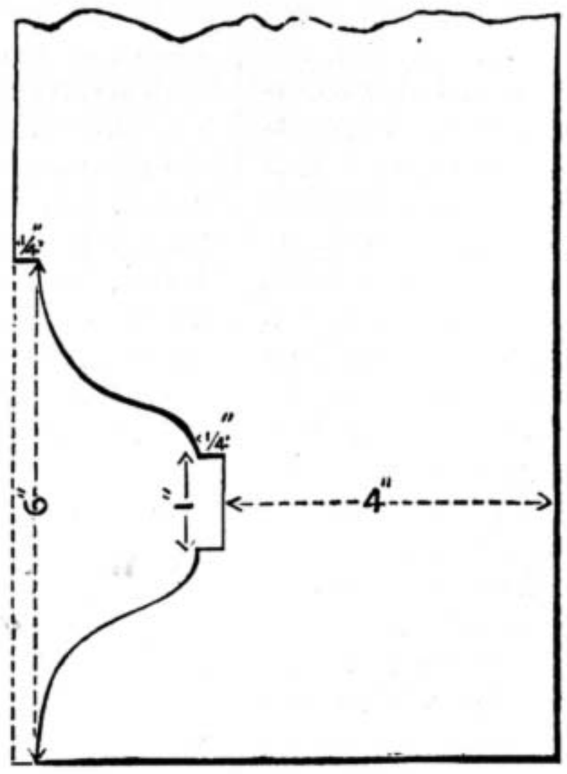
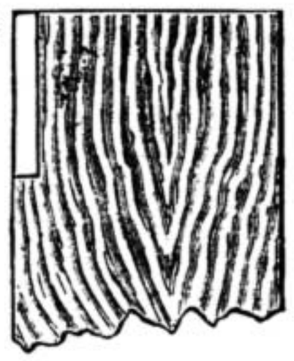


Fig. 5

Fig. 4



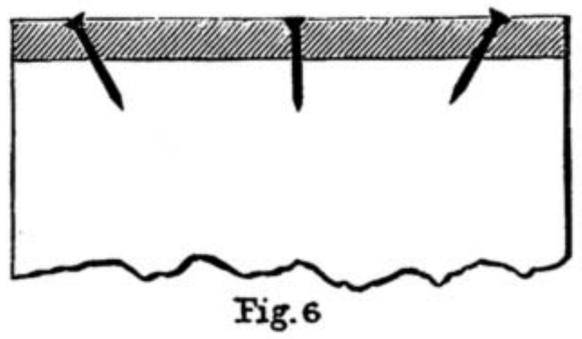


Fig. 6

Fig. 4.—Inner Ends of Overmantel with Recess. Fig. 5.—Outline of Bottom of Ends. Fig. 6.—Method of Fastening Shelves.

Perhaps I ought to say something about the necessity of the wood being thoroughly seasoned, and not only so, but thoroughly dry. For the first qualification, the timber merchant must be relied on; the second is more under the user's control, and as amateurs frequently complain of their stuff going—through what is almost invariably called the use of unseasoned wood—a few words of advice may with advantage be given. However well seasoned wood may be in the timber yard, it is rarely that it can safely be used up immediately without risk of its contracting, and of course splitting sooner or later—generally sooner. It stands to reason that, however well-seasoned in the open air, or even when under cover, wood may be, it can hardly be so free from moisture as to have shrunk to its smallest dimensions. If dried under those conditions, although to the touch or in working it may seem perfectly free from moisture, it will be found that if made up fresh it is sure to contract when placed in a warm, dry atmosphere, like that of an ordinary living-room with a fire in it. If the construction is such that the inevitable shrinkage has not been provided against, the almost certain result is a split; perhaps two of them, the second being with the timber dealer for having supplied unseasoned (!) wood. To prevent the wood shrinking, warping, or going wrong after it has been made up, give it a fair chance to do so beforehand. Keep it for a few days in a warm, dry place—if possible, in a room where there is a fire, especially in the winter time—before cutting it, or at any rate, before finishing it. If the wood has been well-seasoned there will not be much fear of it going or displaying any of these vagaries, generally attributed to the want of proper seasoning, and it must be confessed sometimes correctly so. Instead of pine, American whitewood will be a very good wood to use, but it is a little more expensive. For staining, it is, however, to be preferred. Nevertheless, there are now such an immense variety of the so-called enamel paints, that those who wish to do so can finish the furniture more easily with one or other of them than by staining and polishing.

We are, however, getting ahead to the final work before the overmantel is begun. The first thing will naturally be to make a full-sized drawing

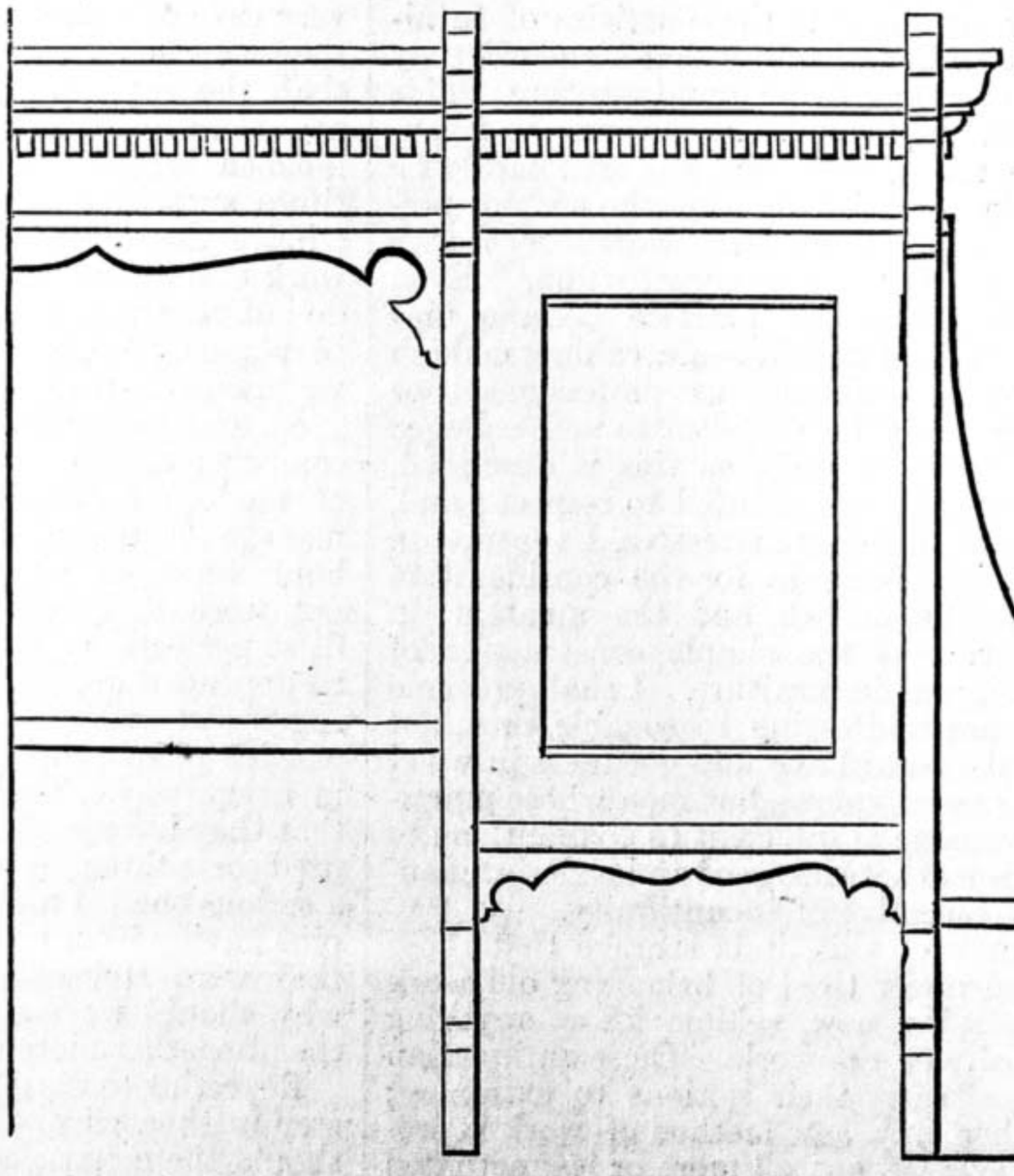


Fig. 2.—Half of Front Elevation of Overmantel.

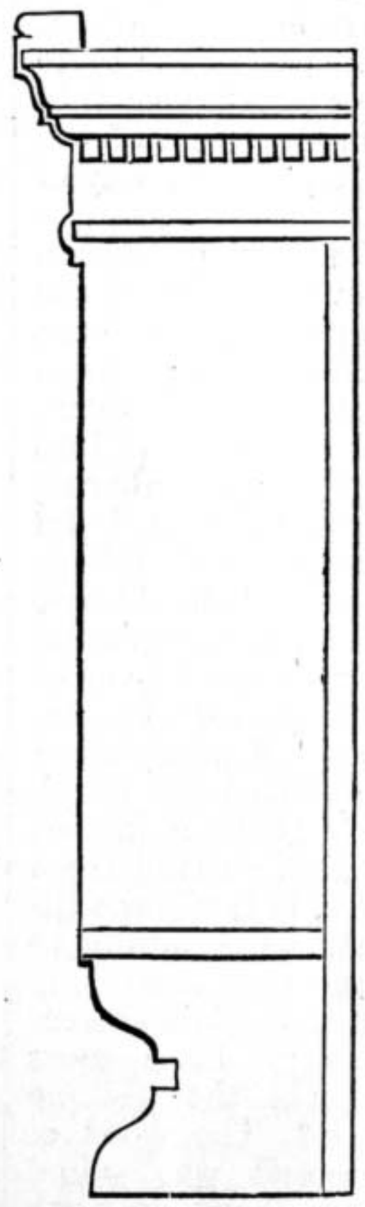


Fig. 3.—End Elevation.

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of the overmantel, as by its aid measurements of the various parts can be got much more correctly than without. The drawing need not be at all an elaborate affair; indeed, it will be far better not, for the simpler it is the less likelihood of any mistake being made, always provided of course that it shows sufficient to guide the worker. In such a thing as this it is not necessary to show joints. It will be quite enough if a front and end elevation are prepared, as shown in Figs. 2 and 3. For the sake of simplicity and to save space only one-half of the former is shown, the other half being exactly the same. As these drawings are made to ½ in. scale, there will be no difficulty in seeing that the size of the overmantel is as follows: Length, 4 ft. 8 in.; height, 2 ft. 5 in.; depth from back to front (on cornice), 8 in. These dimensions, of course, may be varied according to circumstances, for the veriest tyro need not be told that with a chimney breast only 4 ft. wide it would be absurd to make an overmantel as long as the one illustrated. It will be seen that the design is not one of the gorgeously reflective sort, but then it will be remembered the kind of room it was made for required something more useful than—I was going to say, ornamental, but I hope it is the latter as well. Utility, however, was of more importance than decoration alone, hence the small space available for looking glass. As a matter of fact, there is none of this latter in mine, but as an overmantel without glass might not suit every one, I shall, in due course, show how mirrors may easily be fitted without altering the construction. Possibly also some may prefer to have no shelf in the centre portion, and for the benefit of such I shall, in the proper place, explain the slight difference which its absence will render necessary or advisable.

In the meantime I shall show precisely and exactly how the overmantel as represented is made. The necessity—if the thing when made is to look well—of having the wood properly planed, and not only so, but perfectly smooth—no plane marks or flaws of that kind—is so self-evident that it need not be insisted on. To get the surfaces into this desirable condition first plane them, then scrape them to take out any trifling irregularities, and finally glass-paper. This latter, however, may be deferred till just before fitting together, particularly if the work is not to be painted. The edges of the wood must also be planed up as truly as possible, and of course every cross cut should be perfectly square. If it is not it will be hopeless to expect that the work can look well, however much pains may be taken with it otherwise. Roughness in finish may pass without offence; bad construction cannot be regarded with equanimity. The latter is the important part of the work; the former, the finish, is of secondary importance. Those who wish to excel will, of course, take the same pains with the one as with the other, for though our work may be cheap it need not be nasty. I saw somewhere lately—I think it was in "Every Man His Own Mechanic," though I am not able to verify the quotation—a sentence which puts the matter very neatly. It was as nearly as I remember in these words: "Though the work need not be well done it will be better if it is;" and whether they are exactly so or not that is their purport. I have insisted on these details because they are applicable not only to our present work but to all other of a similar kind; and having given these general instructions, I may now call attention to the various parts, their respective sizes, and the mode in which they are fitted together.

For the ends or uprights four pieces will be required, each 2 ft. 3 in. long and 6½ in. wide. By the way, as I have not mentioned it before, I may as well remind beginners that though wood 1 in. thick has been spoken of, it must not be supposed it will be of this thickness after having been planed. Even before this has been done it will not be fully 1 in. thick, unless it has been specially asked for, and paid for accordingly. Nominal "1 in. stuff" is what is supposed to be used, and this will measure, when "cleaned up"—*i.e.*, planed, etc.—little, if any, more than ¾ in. It will therefore be well to bear this in mind when setting out the work if, for any reason, exact dimensions, not only of this overmantel but of other furniture, are to be worked to. I may as well also state here that measurements are not given to within ⅛ in., as to do so would merely tend to error, and cramp the worker by imposing needless restrictions. Measurements will only be stated by

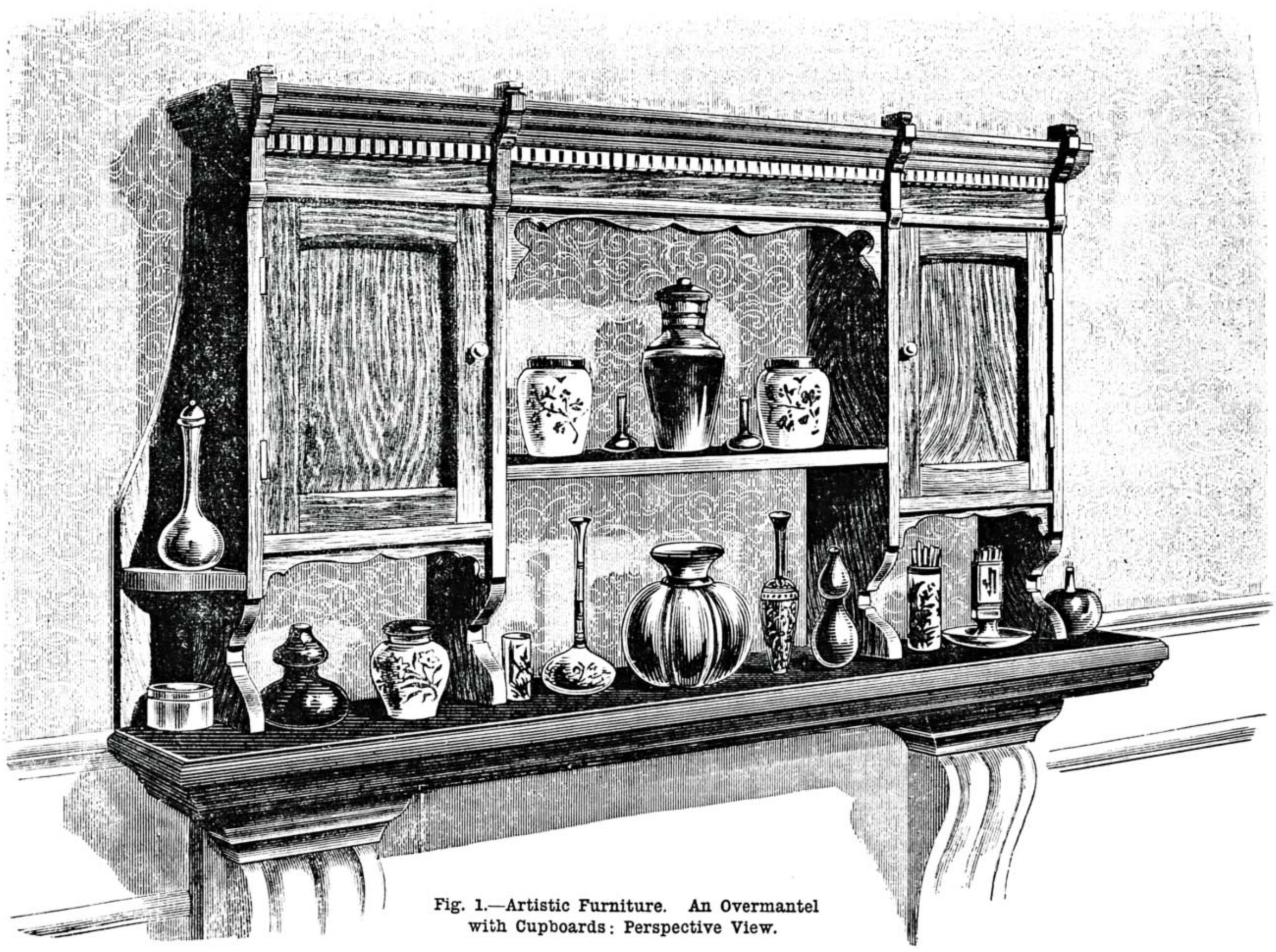

Fig. 1.—Artistic Furniture. An Overmantel with Cupboards: Perspective View.

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the half-inch, which for explanatory purposes is quite sufficient, so that, in case of any dimensions not tallying exactly, it will be understood that parts less than half an inch are disregarded, except in the very few instances in which it will be necessary to mention them. Of course, in actual work the same disregard for fractions cannot be entertained, as they must be carefully noted.

Two pieces, each 11 in. long and the same width as the ends, will also be required for the bottoms of the cupboards, and two more of the same width, but longer than the bottoms by the thickness of the two ends. Thus, if these finish ¾ in. thick, the pair will make 1½ in., which, added to the length of the bottom of the cupboard's 11 in., gives us 12½ in. One piece the same width as the foregoing but 1 ft. 10 in. long will be wanted for the centre shelf, and another for the top of the same part of equal length, but ¾ in. narrower, to allow for the thickness of the next piece. This, which is 4 in. wide, and in length equal to the whole of the front less the thickness of the two outside uprights, will also have to be prepared before any of the fitting together can be done. To get at this length exactly, either measure from the working drawing or, what amounts to the same thing, add the length of the centre shelf (22 in.), the thickness of the two inner uprights (1½ in.), and the length of the two pieces for the bottoms of the cupboards (22 in.), giving a total of 3 ft. 9½ in. Now take the two inner end pieces, and from the top front corners of each cut a piece out exactly the width and thickness of the long piece, the frieze, just prepared.

To prevent any mistake as to how these spaces should be cut out, the diagram Fig. 4 is given. This represents the top of the inner end pieces, the part within the thick lines being that which is to be cut away. To mark these spaces out accurately, set the gauge—either the marking or the cutting variety being available for the purpose—to exact thickness of the frieze; then, with the block of the gauge against the front edge of the uprights, scribe for a length of at least four inches from the top. If the scribing is done on the top edge and on both sides of the wood the lines will furnish an aid to correct sawing, or to trimming up accurately afterwards with a chisel if necessary. This, of course, will not be requisite for those who are practised hands, but such adventitious aids are not to be despised by the unskilled worker, as by taking advantage of them he may turn out work as accurately made as that done by the most experienced. He will naturally require more time to get the same results, but these will well compensate for the extra pains taken. He must not hope to emulate the practised worker in speed, but he may reasonably expect to do so in accuracy—if he has the necessary patience.

The length of the piece to be cut away can most easily be ascertained by laying the frieze on the wood and marking off the width. When this is arrived at the square should be used to mark the lines, not only on the front but also on the sides, as far as those made by the gauge. Now it is evident that the cut made by the saw is of an appreciable width. It cannot be less than the thickness of the saw blade and set of the teeth, so that unless a very fine saw is used it will be found that if the wood is cut on the line, that is to say, if the saw passes through this, the space, when the waste piece is removed, will be found rather larger than necessary. In other words the frieze will not fill up the recess properly; it will not be a good fit. In this instance this would not be of much consequence, still it is better to form good habits of work at once. After what has been said, the natural inference will be that by cutting along the inner edge of the marked lines, *i.e.*, within the waste piece, so that a saw cut is formed in it, the space left will be just of the required dimensions. In any case if it is not big enough, a little paring with a chisel will soon effect all that is needful; for it is always easier to reduce wood than to add to its size when fitting; an axiom which the beginner will do well to remember.

When the frieze is fitted properly the pieces so far arranged may be fastened together if the shaping has been done on the lower parts of the ends, for this cannot be managed afterwards. Fig. 5 shows as clearly as possible, on a small scale, the outline of this shaping, all the principal measurements from which it can be set out being given in inches. The best way to get the outlines on the four pieces alike will be to form a template. As it may not be understood what this means, it may be explained as a piece of cardboard or thick paper cut with a knife or scissors to the exact outline. By laying this template, or mould, on the wood in position and drawing with a pencil along the shaped edge, all will be exactly the same. It will be noted that the upper curve is a counterpart of the lower, so that the drawing required for the outline is reduced to a minimum. The actual cutting may be done with a bow saw, but, of course, the work may be done with much greater facility with a good fret machine. I leave out of the question a band saw, as this is not often seen or required by amateurs. To prevent disappointment to those who are getting a fret machine, it may be said that I do not refer to makes which, though they may be good enough in their way, are too small to do such large work easily. With such a machine as the Britannia Company's No. 8, which for all-round purposes I consider the best in the market, there is, however, no difficulty in shaping such work as the present. The ordinary fret saws, however, even of the highest numbers, are hardly stout enough to be durable in cutting such thick stuff, and it may be news to some readers that, recognising this, the same Company have placed on the market some especially strong saws, which will be appreciated by sawyers who have once tried them.

Before fixing these parts together, mark with the square across the ends the exact positions of the shelves in order that these may be fixed truly and not sloping in all directions. The lines may be run across showing the thickness of the shelves, but it will only be absolutely necessary to make one for each shelf, indicating where either the top or bottom is to go. The first parts fixed together may as well be the centre shelf between the two ends. Its upper surface is 11 in. from the bottom of the overmantel, so the guide lines having been carefully marked on the inner sides of both the end pieces, mark with the square another line on the other side of each. These lines serve as a guide where to insert the nails, so that they should be drawn about half the thickness of the shelf nearer the lower ends, when if the nails are driven in straight they are bound to go well into the shelf. Screws may be used, but ordinary French nails will do well enough and hold just as securely if driven in as shown in the diagram Fig. 6. This represents the end in section with the shelf nailed to it. It will be seen that the end-nails instead of being driven in perpendicularly are inclined towards the centre of the shelf. Were they all to be straight like the middle nail, it is very evident that the pieces could easily be separated, but by inserting them at an angle they bind the pieces so firmly together that no stronger joint will be needed. The comparative strength of the two kinds of joint can easily be tested by experiment on a couple of waste pieces. To avoid repetition, it may as well be said, once for all, that, unless otherwise stated, it will be better in any of this nailed furniture to have one or two of the nails in a slanting direction, every precaution, of course, being taken to see that the slant is not towards the surface of a shelf. If preferred, the nails may be driven in straight, and in most instances would probably hold sufficiently, but as there is no more difficulty one way than with the other, it is just as well in case of doubt to choose that which seems the strongest. Three or four 2-in. nails, either French or of another kind, at each end of the shelf will hold it well enough. Drive the first nails in straight, and put the slanting ones in afterwards; and do not put more than one nail in any joint till it has been carefully noted that the pieces of wood are in their right position towards each other. To avoid accidents, of course, holes will be bored with a bradawl before the nails are hammered in. The holes need, however, only go through the first piece. The nails will easily make their own way into the end grain of the other, though just to guide them the bradawl may go a little way into this. These are very elementary details, but without some knowledge of them the beginner might fall into errors which could only lead to dissatisfaction with his work, so I trust those more advanced will not deem them needless.

(*To be continued.*)

"TIPS" FOR TYROS.

BY OPIFEX.

1.—Decorative Work for Panels.

Figures, flowers, etc., are very effective for decorative purposes when painted in oil colours upon a dull gold ground, and charming panels may be produced in this style. Cabinets, etc., with plain panels may be altogether transformed by placing other panels of tin, zinc, etc., thus treated, over them, cutting out the metal to fit exactly inside the moulding, then gold lacquering and painting, and, finally, securing by means of invisible pins.

Suppose we require a small panel 12 in. by 6 in. Cut a piece of common tin, or zinc, of the proper shape and dimensions; procure some gold size and best copal varnish, say half a pint of each, and mix together. Also a small packet of gold-bronze powder, costing about 1s. 6d. at any oilman's, and a camel's-hair brush—a gilder's "dabber" is best, and costs 6d.

Give the panel a thick, but even, coat of this mixture, or pour about a table-spoonful upon the centre of the panel, and let it run all over evenly—after the manner of photographers covering a plate with

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colodion—but this only in case of very small panels. This varnish will dry very rapidly, provided the ingredients are good and fresh, so must be carefully watched, as the gold powder must be applied before it is dry, and half an hour, or even less, will generally be sufficient time to wait.

Next dip the brush well into the gold powder, taking up as much as possible; dust it over the panel unstintingly, at the same time being careful not to touch the surface with the brush. This should be done several times until the panel is well covered with the gold powder. You may now venture, very gently and lightly, to apply the brush—and remember that you cannot have too much gold powder—and sweep it over the surface, hither and thither. The gold powder will protect the surface of the varnish from being abraded by the brush, and the result will be, if great care has been taken, that a perfectly smooth, gilt surface will be imparted to the panel. It may now be laid flat in a warm place until perfectly dry, when the surplus gold powder may be brushed off, and the surface rubbed lightly with a pad, formed by folding a piece of chamois leather several times.

The panel is now ready to be painted upon, after which, the whole should receive a coat of mastic varnish.

HOW TO MAKE A WOODEN COPYING PRESS.

BY DAVID DENNING.

THE press about to be described is essentially a home-made affair—one of those contrivances emanating from an amateur's brain, and capable of construction by hands almost unskilled in any handicraft. It is so simple that one feels almost that some apology is due for volunteering any instructions about it; but remembering that all amateurs are not adepts in contriving, any more than they are expert in making, the following hints may not be without value to some readers. The advantage of keeping copies of one's letters—at any rate, of those of a business character—is so generally recognised that nothing need be said about the desirability of doing so. The form of machine or press usually employed for the purpose is well known; but, if we except those of a portable character, they are entirely of iron, and quite unsuited for construction by amateur mechanics as a rule.

I had long intended getting a copying press for home use, but the cost had always been an obstacle. By degrees I began to consider if I could not make one which, even if not so neat in appearance, should be as effective as those sold for the purpose.

First question—Is it necessary that it should be iron throughout? Answer—No. Second question—Could not most or all of it be made of wood? Yes, certainly, except the screw. There came the stumbling block, for it seemed as if this must be of iron; or even if wood could be made to answer the same purpose, where could a suitable screw be got? On inquiring what one would cost, I found it was more than I cared to give, and it seemed a useless expenditure to buy a box and tap to make one, especially as there was no certainty that I should be able to succeed in working it. The matter remained in abeyance accordingly, till one day a discarded bench screw turned up among some rubbish. Why not make a trial with it? It was not wanted for any other purpose, and in the event of the press not being a success, no great loss would result. Anyhow, it seemed just the thing that was wanted, though, probably, if it had not been obtainable, some other arrangement whereby the requisite pressure might have been got could have been devised. Still, it was the ordinary screw press that appealed to my fancy, as no other form seemed so suitable. Perhaps, also, the knowledge that napkin presses, almost identical with copying presses, are made entirely of wood, first suggested the idea of making one. Certainly, compared with one made of iron, the wooden press is clumsy—even a makeshift, if you will; but are not practical "makeshifts," after all, the pride of the amateur? There is the satisfaction of having formed something useful out of what was probably little more than waste. Of course, it is very pleasant, no doubt, to be able to have the best and nicest thing of its kind; but, failing this, by a little consideration one may often be able to contrive a very fair substitute. That is all the wooden copying press pretends to be. It does not aspire to the dignity of a new invention; perhaps it is merely conceit that regards it as anything but a worn-out idea obtruding its insignificant self; if so, good readers, forgive it and pass on to a more congenial article. Allusion has been made to the press being constructed of waste material; and if pieces of an old packing case which had been put aside for breaking up into firewood can be called so, it is literally true. There is, however, no absolute necessity for getting a packing case for the purpose, as wood from the plank will do equally well—better, perhaps. The fact of my press having been made from an old case is merely mentioned to show beginners that they may make use of what may at first sight seem very unpromising materials.

From what has just been said, it will readily be surmised that the press is made of pine, in the selection of which the only precaution taken was to get the pieces as free from knots as possible. The thickness was already determined for me, the case being entirely of 1-in. stuff, which, planed up, measures only a trifle over $\frac{3}{4}$ in. It does very well; but having got beyond the experimental stage, if I intended to make another press, a little more regard might be paid to appearance, in which case a harder wood might be used. Beech would answer well; while a really handsome press might be made by using mahogany or walnut, the cost of which is not great. However, enough has been said about material; and as for workmanship, I would merely caution the tyro against careless work under the erroneous impression that common wood deserves no better.

The general construction of the press may be gathered from Figs. 1 and 2, which give the front and end. The length is $14\frac{1}{2}$ in., and the width, 9 in., which allows of the ordinary quarto copying book being used. It will be seen that the only pretence at ornamental finish is in the rounded ends of the upright pieces, the remainder being "as plain as a pikestaff." The thing was made for use, not for show; and no unnecessary time was spent over it. Those who want to make something better looking will have no difficulty in making improvements, while following the same constructive details. For example, a moulding may be planted on the edges all round the bottom, and a small moulding may be worked on others. Chamfered edges would also be effective and not difficult; while various other details will doubtless occur to the worker. The bottom piece, A, or bed of the press, is $14\frac{1}{2}$ in. long by 9 in. wide. On the under side are screwed two pieces, B, one at each end, serving to give rigidity to the bottom. I am now inclined to think they might have been dispensed with, as the press is screwed to the top of the piece of furniture—a dwarf bookcase—on which it stands. This alone secures the stability of the press; but, as I was undecided where to place it, the cross pieces were used as an extra precaution against weakness. The two uprights, C, are 12 in. long by 3 in. wide, fitted to the bottom with a plain single dovetail joint. The transverse piece, D, 4 in. wide, and of course the same length as the bed, is $2\frac{1}{2}$ in. from the top of C, through each of which a couple of mortises are cut for corresponding stout tenons in D. Through this a hole is cut to allow the screw to pass freely, and on the underside the threaded block, E, in which the screw works, is fastened. I may here say that originally the block was placed above D, but on using the press for the first time this was found to be a fault, very little force—hardly, indeed, more than was required to copy a letter—being sufficient to pull the screw block away. Probably, had D been made of hard wood this would not have happened. Naturally, the tendency of the screw, when using the press for copying, is to force the block, E, upwards; so, to prevent further mishap, the alteration to the present position was made with very satisfactory results.

The movable board, F, is exactly the same size as the bed, which it resembles in every respect, except that at each end spaces are cut away to allow of the uprights fitting loosely into them; and that only one piece, G, instead of two, is fixed across. Now, all these parts might be fitted together, and the press would be effective so far as copying is concerned; but there is the objection that the loose board, F, would not rise with the motion of the screw, and I judged it would be awkward to lift it each time the book was put in the press. Some contrivance by which the action of the screw would raise as well as depress was wanted. Not being a mechanical genius this required consideration; but now that it is done the solution of the problem is as simple as that connected with the historical egg of Columbus. The end of the screw, as is generally the case, was tapered beyond the thread; and it did not seem as if this shape would conduce to effective action. I therefore cut the rounded portion off with a saw, leaving the bottom end of the screw perfectly flat. I then got a piece of zinc plate, about $\frac{1}{16}$ in. thick, and screwed it to the underside of the cross piece, G, about the centre. The size of this piece of metal is immaterial—all that is necessary being that it is large enough to allow of it being properly fastened with two or three screws, and to have a hole about $\frac{3}{16}$ in. bored through it. The shape also is of no consequence; and that of the piece I used may perhaps be best described by saying that it is irregular—very much so, indeed—for it was simply a scrap remaining from a plate out of which I had been cutting a piece of metal fret. In case it is supposed that only zinc would do, it may be said that the only reason for its having been employed was that it was lying handy, and that had a suitable-sized piece of brass presented itself it would probably have been used instead. Indeed, I am inclined to think that the metal might be dispensed with altogether

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without much, if any, disadvantage, especially if the piece, G, is of some hard wood. Still, I don't know; and the suggestion is only given for what it is worth to those who want to expend as little labour as possible on the press. It is seldom that one's first attempt at making anything is so good that it can't be improved upon, either by eliminating superfluous features of construction or by giving it an enhanced appearance—both considerations worthy of attention if they can be accomplished without detriment to utility. Therefore, it is to be hoped that these instructions will not be so far mistaken as to be regarded by any would-be press maker as admitting of no variation. They are merely given as a record of the way my press was made, and so far they are reliable. Whether the suggested alterations are improvements, or the reverse, must be left for each maker to decide for himself. For example, some may not have tools to bore the screw holes through the plate; and it would only discourage such at the outset to tell them they *must* use a metal plate. If I may offer a suggestion here, though one hardly directly concerning the subject, it is—that fellow-contributors, while telling us what ought to be done to produce the best results, might, when practicable, indicate "short cuts." But to make a "short cut" of this press: A hole was bored through the metal plate and G big enough to allow a large screw nail to revolve freely within it. This screw was then run through the hole and driven into the bottom of the wood screw, care being taken that while this and G were brought close together, the latter could be turned round easily on the screw nail as an axis. In order the better to explain this, Fig. 3 is given, showing in section the metal plate at the bottom, the wooden piece, G, above, with the nail passing through them into the screw. The spaces round the nail and between the bottom of the screw and G are slightly exaggerated for the sake of clearness, for it will be understood that the more closely the parts fit without binding the better the work will be. In order that G may be screwed down closely to the piece F, the latter is slightly scooped out to receive the metal plate and screw head.

The parts are now ready for fixing together, and when done, the press as made is complete. Of course, I am supposing that each part is separate so far, and that any fitting together has been merely tentative. Perhaps it may be an assistance to beginners if they are told how to fit all the parts together.

Screw the two pieces, B, to A, though this has probably been done when cutting the sockets for the dovetails at the end of C. Pass the wooden screw through D and then through E. Fasten these (D and E) together, taking care that the wooden screw does not jam in the hole through D, in which it should revolve freely. Then attach G to the end of the wooden screw. Next fix one of the end pieces, C, to the bottom, when F may be placed in position. The tenons at the end of D, corresponding with the mortises in the piece C, already fitted, may then be inserted; and finally the remaining upright, C, be fastened. Glue should be used at the mortise and tenon and dovetail joints; but it will be better to fasten the other parts together with ordinary screw nails. It now only remains to screw G to F, and the press is complete. Nothing has been said about the handle by which the screw is turned; but I presume it will be understood that this is the ordinary one supplied with it for bench purposes. Any tough stick would, however, do as well; and instead of leaving it loose, as it generally is in bench screws, I have found it convenient to fasten it in by a couple of brads—one on each side—so as to keep the handle immovable.

In the preceding page napkin presses were alluded to incidentally. These, though by no means generally met with nowadays, when we are apt to regard them as old-fashioned, are not to be despised as a convenient means of keeping such things as table-cloths, etc., nicely pressed. In some households they are still in constant use; and for the benefit of those who desire to make one, it may be said that the linen or napkin press very much resembles in construction that just described for copying. In size, however, it is considerably larger, but as the dimensions are governed by the articles to be kept in it, no specification can be necessary here. In construction the principal point of difference is that the handle of the napkin press, instead of being at the top, is usually found placed between the parts marked in the illustrations as D and F. In the copying press this would have been awkward, owing to the comparatively short space between the two uprights; but in the larger linen press this objection does not exist; and for practical reasons the lower position is generally chosen. There is, however, no actual necessity for this, so that those who want to make a linen press may, if they prefer to do so, make one in every respect like the press now described, merely altering the sizes to suit their own requirements.

It will, no doubt, be perceived that such a press may be turned to a variety of uses, and that its utility is not confined to copying letters. For example, the amateur cabinet maker will find it handy in laying small veneers with a caul, the photographer in mounting and pressing his works of art, etc. etc.

So far, only the press as I have described it has been made; but, before long, it is probable that a stand will be contrived specially for it. If so, I shall have much pleasure in giving particulars in a subsequent article, and describing the methods that I may be led to adopt in making it.

Fig. 1.

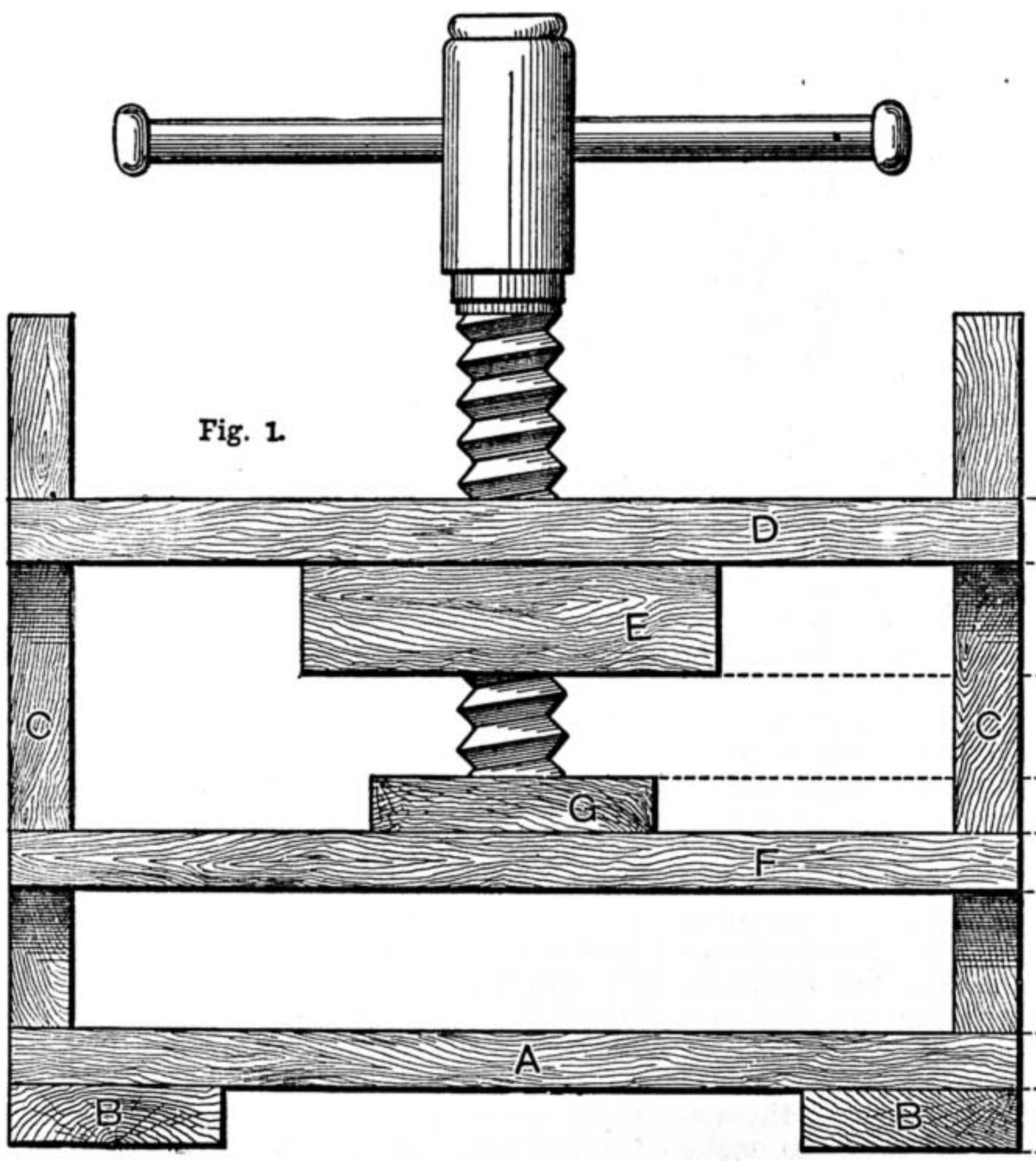

Fig. 3.

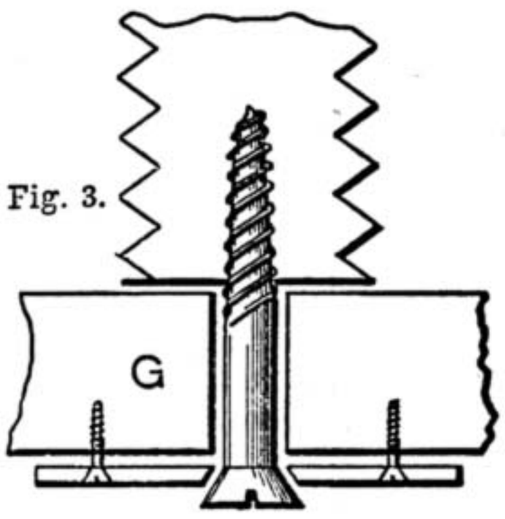

Fig. 2.

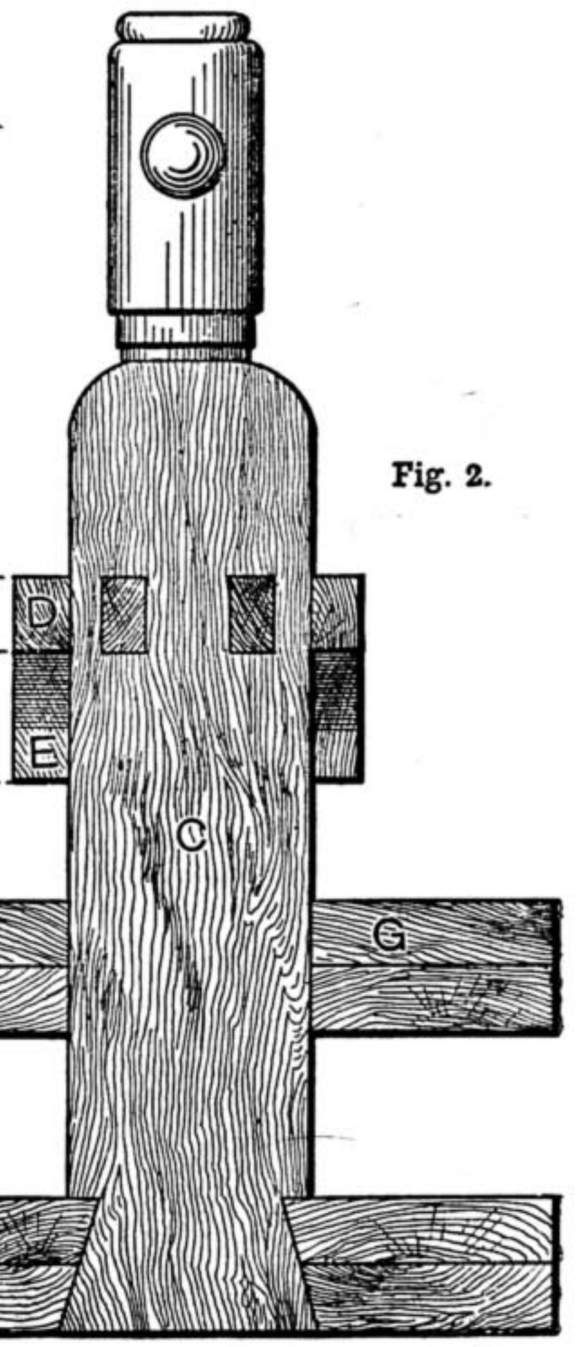

Fig. 1.—Front Elevation of Press. Fig. 2.—End or Side Elevation. Fig. 3.—Diagram Showing Mode of Attaching Wood Screw to G.

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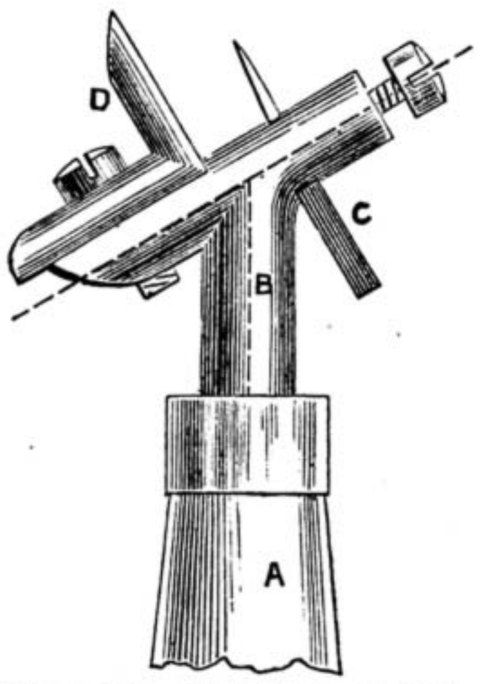
OUR GUIDE TO GOOD THINGS.

6.—The Britannia Company's New Patent Saw.

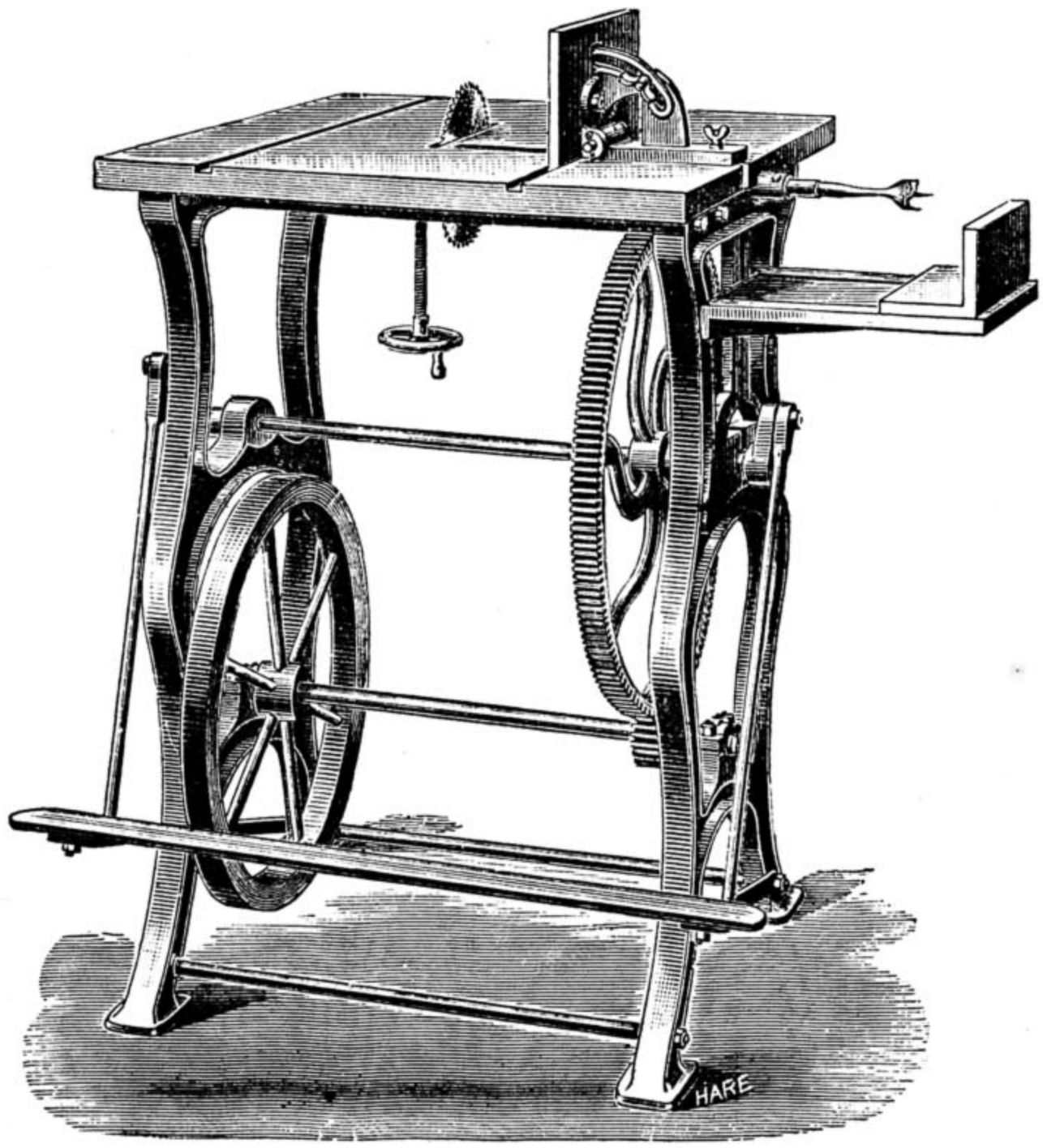
A circular saw is a tool which no workman who has once seen it at work would care to be without, for it is a labour-saving tool of the first importance, and enables its owner to do many things with an amount of ease, exactness, precision, and rapidity that cannot be attained with saws actuated by the hand and arm. When an amateur becomes the possessor of a lathe, one of the first things he will do is to have it fitted with a circular saw and the necessary appliances in the shape of table, fence, etc., to enable him to use it conveniently and with due effect. The professional workman, on the other hand, although he will not be without a circular saw to be worked on and by his lathe, wants something stronger and heavier that will save him the labour of using the rip saw, which has made many a man's arm and shoulder ache when the absence of suitable machinery in the workshop has compelled him to keep at this kind of work for many successive hours, perhaps, if not through the entire day; and every man who seeks to save time and labour, and therefore money, either for himself or for those in his employ, will, or ought to, take care to have a thoroughly efficient machine well suited to the requirements of his business in his workshop.



Adjustable Rebating Cutter.—A, Handle; B, Brass Casting; C, Cutter; D, Fence. Dotted lines show Angles of Inclination of Cross Piece to Axis of Handle.

I may say, with confidence, that I do not know a better all-round machine for general purposes than the New Patent Saw made by the Britannia Company, Colchester, Essex, of which the annexed engraving is an excellent illustration. It is a very powerful machine, well made and well put together, and suitable for workshops even of a small size, because it is compact in itself and does not take up much room. I have seen the saw in operation, and was astonished to note the "go" that is in it, if I may use the term, after the motive power has been removed from the treadle. When I saw the machine at work at the Company's London showrooms, 100, Houndsditch, where every machine and appliance made and sold by the Company may be seen and examined, the exhibitor set it running and then took his foot from the treadle. After some little time had elapsed, during which the machine continued in action just as if some invisible agency was keeping it going, I was asked to stand on the treadle. I stepped on it and stood there, but in spite of the dead weight that was then thrown on it, the machine went on as gaily as ever, and did not come to a full stop until some little time after I had stepped off the treadle and stood once more on the floor of the showroom. I regretted afterwards that I had not timed the duration of the running of the machine from the time the exhibitor ceased to actuate it until it stopped. I shall do so, however, the first opportunity I have of renewing my acquaintance with it, and then, through the medium of "Shop," I shall have much pleasure in answering the inquiries of an intending purchaser, or any one else who may be curious in the matter.

So much, then, in testimony of its power, which enables me to accept the assertion of its patentees and makers, that when the saw is worked by foot "4 ft. of 1 in. pine can be cut after the foot is taken off the treadle. It is claimed, moreover, for the saw that it will cut 10 feet of inch wood in a minute; and that with one man working at the treadle—for it may be worked by hand power as well—it will cut up to 4 in. square. This, in fact, bears valuable and incontrovertible witness to the worth of the saw as an economical machine, and goes far to make good the Company's claim that it will compare favourably in point of work done with any other treadle saw in existence, and that it will save its prime cost in the first twelvemonth of its use.



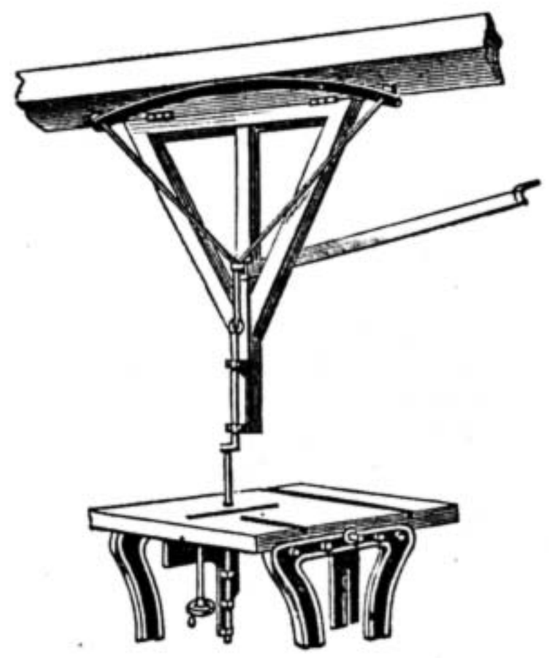
Britannia Company's New Patent Saw for Cabinet Makers, Joiners, etc.

The construction of the machine will be readily understood from an inspection of the accompanying illustration. The saw table is supported on a couple of standards, firmly connected and braced by bars, entering the standards a little above the feet on each side. Provision is made in the framing of the standards for the reception of two axles, the lower one carrying the heavy fly-wheel on one side, and on the other a pinion which gears into a large and heavy toothed-wheel, on the right side of the higher axle, to the ends of which are connected the bars that form the intermediate links between the treadle and the shaft that carries the large toothed-wheel. The end of the shaft to the left is so contrived that a handle can be fitted on to it, which may be used either as an auxiliary to, or instead of, the treadle. The large toothed-wheel gears again into a small toothed-wheel on the axle which carries the circular saw, which, when in motion, may be made to effect 1,500 revolutions per minute.

The table is fitted with the necessary appliances for the performance of various kinds of work in the form of fences, etc., and at the right side of the machine there is an adjustable table, on which dowelling is done, fitted with a special appliance for holding work and insuring uniformity. On this side is also a chuck for holding bits of various sizes for boring, which can be done with great rapidity and up to 2 in. in diameter.

In addition to dowelling and boring, grooving can be done at considerable speed, and mitre cutting is performed with such cleanness of cut and rapidity that the ordinary gilt mouldings used for picture frames can be cut without any shake, and will not require planing or finishing. For scroll cutting there is a separate appliance, of which the upper arm is suspended from the wall or ceiling, and only let down when wanted, thus leaving the table quite clear for work of any size. Timber, to the thickness of 4 in., may be cut with the vertical saw. The patentees and makers are about to add a moulding appliance to the machine, by which mouldings may be cut with a single cutter.

The adjustable table shown at the side in the illustration, for boring, can be removed at pleasure, and another table be substituted with suitable appliances for holding work for mortising. This operation is effected by using a fluted bit, which is placed in the same position as the centre bit shown in the illustration. The fluted bit, which cuts on the side, first drills a hole in the wood, and then completes the mortise by means of the screw movement. The price of the mortising appliance is £3 10s.



Vertical Arm for Suspension to Ceiling or from Wall, as Appendage to Patent Saw for Scroll Cutting by means of Vertical Saw.

The dimensions of the machine are as follows:—Height of upper surface of table from ground, 3 ft. 4 in.; length of table from back to front, 2 ft. 9 in.; width of table along front, as shown in illustration, 2 ft. 4 in. Area occupied by machine, or extent of base from outside to outside each way, including treadle, 2 ft. 9 in. by 2 ft. 9 in. In addition to what has been said above of the persistence of motion in the machine after the motive power has been removed or stayed, it may be said, in order to give a better idea of the momentum accumulated by the saw, that if six treads be first given you may then *stand upon the treadle*, and it will take you up bodily eighteen times. Generally speaking, treadle saws will cut no more than 6 in. by momentum of saw after motive power is removed, but the New Patent Saw will cut 48 in., or eight times as much as an ordinary saw.

The price of the machine in its simplest form and condition is £15, including a rip saw and a cross-cut saw, each 8 in. in diameter, and a 6 in. saw, with a pair of bevel washers for grooving. The fret arm for suspension from ceiling for fret cutting costs £2 10s. in addition, and 5s. more must be added to the price of the table if the

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purchaser desires to have a 12 in. cross-cut saw instead of the 8 in. saw usually supplied. An additional charge of 7s. 6d. is made for the crank handle to be used at the left end of the axle carrying the large-toothed driving wheel; and £1 2s. 6d. for the adjustable table at right hand side, and chuck for holding bits for boring. Centre bits suitable for the chuck are supplied at prices ranging from 8d. to 1s. 3d., according to size.

In conclusion it may be said that the Patent Saw Table is especially adapted to meet the requirements of cabinet makers, joiners, picture-frame makers, and pattern makers, and for the execution of circular work, grooving, dowelling, and drilling, as has been already pointed out. For amateurs who have room for such a machine, it is doubtful if anything more handy or more serviceable could be found.

7.—Adjustable Rebating Cutter or Knife.

This is one of many handy little tools that have been shown to me lately by Messrs. Richard Melhuish and Sons, 85 and 87, Fetter Lane, Holborn Circus, London, E.C. In the upper end of a nicely formed handle is set a round piece of brass about ¼ in. in diameter and ⅝ in. long. At the end of this piece of brass is set another piece, about 1 in. in length, obliquely, the two arms forming angles of 55° and 125° with the first piece on the opposite sides. The two pieces form a single casting, but I have described them as I have in order to make the construction of the tool as clear as possible to the readers of Work. At all events we have a handle and a piece of brass at the end of it, inclined to the axis of the handle at the angles named. At right angles to the cross piece, at ¼ in. from its extremity, a cutter is inserted which is held in its place by a set screw in the end of the cross piece nearest to which the cutter is placed. Along the other end of the cross piece slides a guide or fence, also held in place by a set screw, which is adjustable, and can be moved a little more than ¼ in. from the cutter, which is ⅜ in. in length. For cutting small rebates not more than ¼ in. each way or for clearing the angle of a rebate already cut this tool will be found useful. It is, however, very limited in capacity, and would be far more useful if made in larger sizes. Its cost is only 1s. 3d., but any one who can manage to do a little brass casting can make one for himself on a somewhat larger scale. In order to give a little assistance to any would-be maker of a similar cutter I have given a sketch of the tool itself.

8.—Fine Three-jawed Drill Chuck.

This well-made little Three-jawed Drill Chuck, as its name implies, will be found of service by jewellers, and all who do small fine work, for holding drills in the lathe, to which the chuck itself must be fitted. It consists of a steel cylinder, into the upper end of which is fitted a tubular piece of iron, cut for the greater part of its length into three sections, the upper parts of which form the three jaws. A screw thread is cut along the upper part of the cylinder, on which a cap works, surrounded by a milled flange. This cap passes over the jaws of the chuck, and causes them by its pressure to grip tightly any small drill that may be placed within them. Its price is 6s. 6d.

9.—Shaped Whetstones for Wood-Carving Tools.

Wood carvers, especially amateurs, often find a difficulty in obtaining, or even shaping, slips of a proper size and suitable form for giving a keen edge to wood-carving tools. A handy set of slips, four in number, has recently been introduced, which will obviate all difficulty in this direction in future. These slips are sold at 3s. 6d., enclosed in a box, in which they can be kept at hand, ready at any time for use when required. They are cut from the best Arkansas stone, and present in front and back every variety of form that can be required for carving tools, whatever may be their shape. They are about 2 in. long and ¾ in. wide.

MEANS, MODES, AND METHODS.

*** *The Editor is not responsible for any statement made under this heading. Criticism and Suggestions are invited. Readers in possession of Tried and Approved Recipes, Formulas, and Processes, are requested to forward them for insertion in this column for the common good.*

Pianos: How to Preserve Them.—It is remarkable how very oddly people proceed about taking care of their pianos—from sheer ignorance. It is a popular notion that pianos ought to be kept very dry. Nothing could be more fallacious. Pianos are not nearly affected so much by heat or cold as they are by dryness, but, reversely, also by dampness. It is not generally known that the sounding board—the life of a piano—is forced into the case, when it is made so tightly that it bulges up in the centre, or has a "belly," as it is called by pianoforte makers, on the same principle as a violin. The wood is supposed to be as dry as possible, but, of course, it contains some moisture, and gathers more on damp days and in handling. Now, when a piano is put into an over-heated, dry room, all this moisture is dried out, and the board loses its "belly," and gets flabby, and finally cracks. Even if it does not crack, the tone loses its resonance and grows thin and tinny, the felt cloth and leather used in the action dry up, and the whole machine rattles. Now how to prevent this. Nothing is easier. Keep a growing plant in your room, and so long as your plant thrives, your piano ought to, or else there is something wrong with it. It should be noted how much more water will have to be poured into the flower-pot in the room where the piano is than in any other room. In America it is the practice to keep a large vase or urn with a sopping-wet sponge in it near or under the piano, and keep it moistened. This is kept up all the time the fires are on.—*Iron.*

Rust Joint.—For making a rust joint that will bear heat, cold, and rough usage, the following is said to be a good formula:—Iron Filings, 10 parts; Chloride of Lime, 3 parts; Water, sufficient to make the preceding ingredients into a paste. Put the mixture between the pieces to be joined, and bolt them together, leaving until dry.

SHOP:

A Corner for Those who Want to Talk It.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

A Good Example.—C. R. (Glasgow) writes:—I have come across your prospectus of your new publication, Work, and I think very much of it so far, and I believe it has a good chance. I shall be glad to act as your agent for this paper. I have a tool and cutlery business, and deal entirely with the working classes. Will you send me a quantity of your prospectuses (if possible, with my name and address), and also instructions, as this branch of business is a little new to me? I shall circulate your prospectus amongst my customers, and endeavour to get orders for Work. Being a practical engineer, I also think I might at times send an article for publication.—[Your request for prospectuses has been complied with, and your communication holds the foremost place in "Shop," as it is hoped it will be the means of stimulating many others in your position to follow the "good example" you have so aptly set in seeking to promote the circulation of Work among workmen, for whose benefit and information it has been produced and published. Any letter or article from yourself or any other practical man will receive prompt attention.—Ed.]

Picture Frames.—J. H. L. (Heywood).—An article on Picture-Frame Making, with illustrations of new forms of frames, will appear in an early number of Work.

Ornamental Brass and Iron Work.—R. B. (Manchester).—Your suggestion is noted; and instructions for carrying out work of this description, with suitable designs, will be given in Work as soon as arrangements can be made.

Working Models.—Church.—Attention will be paid in due time to the construction of working models. It may be noted here that the particular model you require is that of a church, in which, when a penny is put in, the church bells will ring, and the figures of the ringers be seen to pull the ropes. Such a working model would be somewhat complicated in construction, and if you have never tried your hand at one before, it would be better for you to choose something easier and simpler for your first essay, before attempting anything of the kind described.

Trade Notes and Memoranda.

Topics of the Hour.—Underground Railways in Paris.—Health and comfort in interiors.—Westminster Abbey additions.—Speculative building operations.—Oil for street lighting.—Portland cement and sea water.

Sugar is suggested as a remedy for improving mortar.—In future none but certificated plumbers' work is to be permitted upon the Duke of Westminster's property.—£57,000 is asked to drain Margate, which needs drainage.—The fine parish church of Lyddington, Rutlandshire, is to be restored.—The Dean of Westminster has been asked to clear out some of the ugly monuments which now encumber the Abbey.—A temperance hotel is to be tried at the Devil's Dyke.—Electric headlights for trains have been successfully tried in America.—Another attempt is to be made to light the City of London by electricity.—Clacton-on-Sea has just started its much-needed sea-wall operations.

The telephone is developing in Europe. There are now 33,000 telephone stations in Germany, 4,200 in Austria-Hungary, 4,647 in Belgium, 1,857 in Denmark, and 2,218 in Spain. France has 28 telephone systems, of which 2 are in Algeria, while Germany has 164. In 1888 the number of subscribers in France amounted to 9,847, and in Germany to 33,000. The United Kingdom had 122 systems with 20,426 subscribers; Italy 28 systems with 9,183 subscribers. Luxemburg has 15 lines with 483 subscribers; Norway 9 lines with 2,872 subscribers; Portugal only 2 lines, one of which is at Lisbon, and the other at Oporto, with 541 and 349 subscribers respectively. In Russia telephones have also been introduced. There are, in that country, 36 systems with 7,589 subscribers, of whom 1,500 are in St. Petersburg, 700 at Warsaw, 840 in Moscow, and 700 in Odessa. Sweden has 137 lines and 12,864 subscribers. Switzerland in 1888 had 71 telephone lines with 7,626 subscribers, of whom 1,533 are in Geneva, 1,066 in Zurich, 926 in Bâle, and 544 in Lausanne.

At Pergamus a large sarcophagus has been found, near the Acropolis, determining the position of the necropolis of that city.

The East Indian Art Manufacturing Company, situated at the foot of Cumballa Hill, near Bombay, has just laid down new machinery and sawmills, and has enlarged the workshops. About 170 workmen are employed, and some 225 tons of teak and blackwood are converted each year.

The method of preparing the famous cæruleum or Egyptian blue has been discovered by a French chemist. The Egyptian blue is said to have been discovered by Vestorius, but it was not made after the fall of the Western Empire.

A course of lectures on "Architecture," dealing with the practical side, illustrated by sketches, diagrams, and specimens of materials, are being delivered at the Central Institution of the City and Guilds' Institute, South Kensington, by Mr. Banister Fletcher, F.R.I.B.A., J.P., D.L., on Monday evenings, commencing 7.15.

A Paris syndicate has purchased the tin mines of Villeder, which were about to fall into the hands of an English company. These mines are being erroneously represented as the only source of tin in France. But tin has been found in Bretagne from remote times. The tin mine at Montebras (Creuse) is still being worked.

A series of examinations will be held under the auspices of the Carpenters' Company during the last week in June next, when gold, silver, and bronze medals (one of each), and certificates, will be awarded to successful candidates. The examination board includes Messrs. Banister Fletcher, T. Roger Smith, and W. Wilmer Pocock, and the presidents of the Institution of Civil Engineers, the R.I.B.A., the Architectural Association, the Builders' Institute, and the Clerk of Works' Association. Candidates must be between twenty-one and thirty years of age, and have passed at least in the ordinary grade of the examination in carpentry and joinery conducted by the City and Guilds' Institute.

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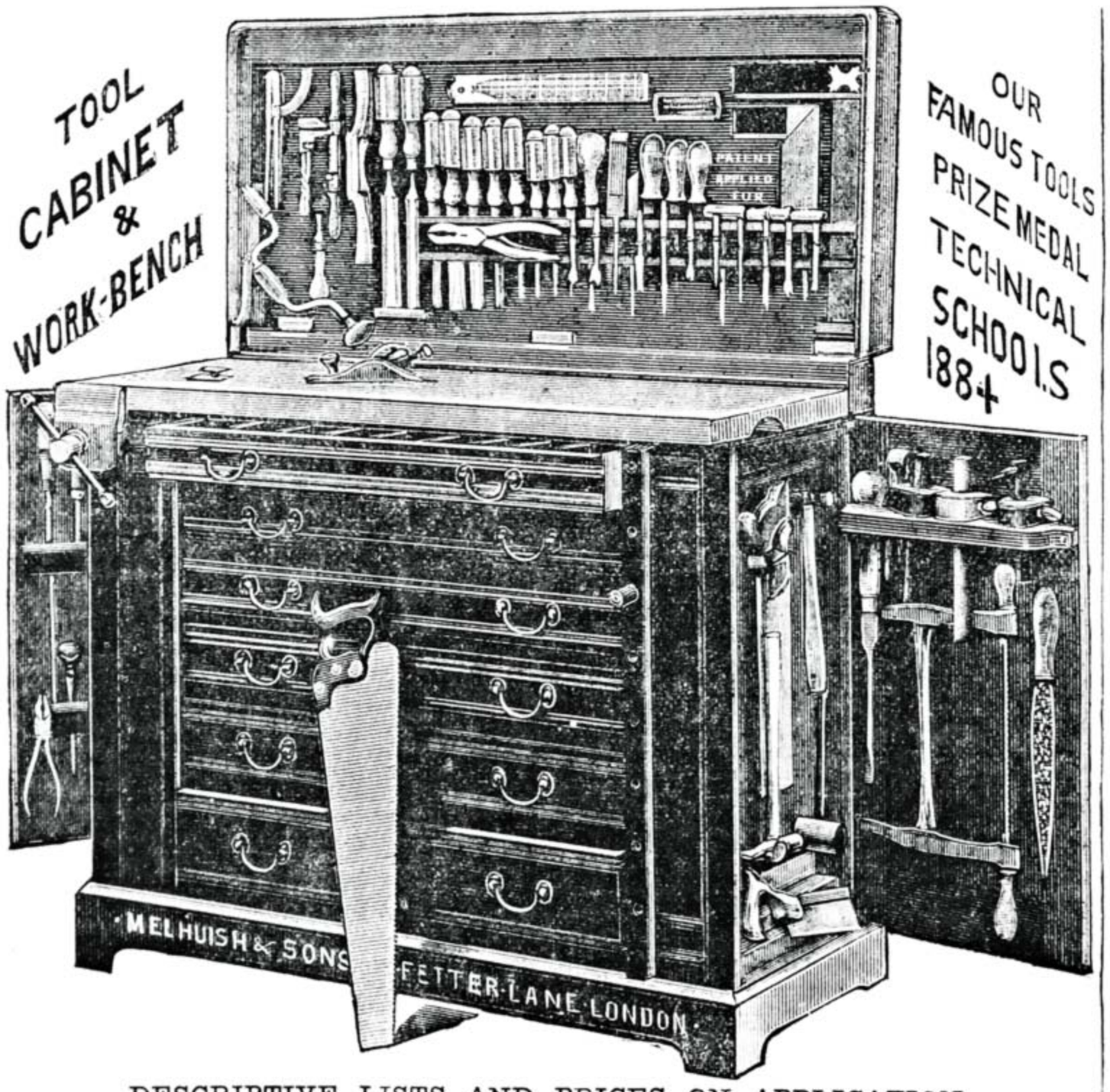

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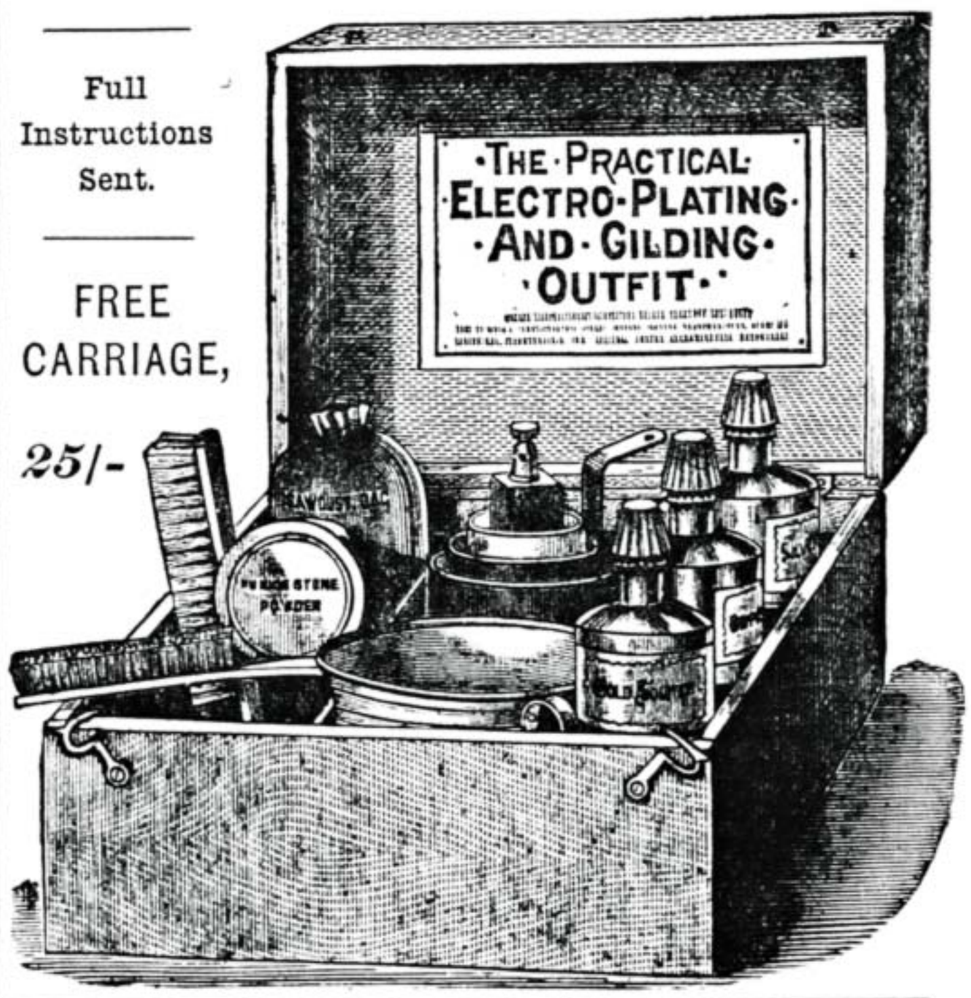

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